The Sutro Railroad

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AN ILLUSTRATED REVIEW OF THE INDUSTRIAL APPLICATIONS OF ELECTRICITY, GAS AND POWER.

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TABLE OF CONTENTS

EDITORIAL:— Page.
Policy in Railway Management....34
Electricity Is Not a Cure-All.....34
The Mission of Journalism.....34
Import of Roentgen's Discovery....35
PASSING COMMENT:—
Influence of Trollies on Telephones.36
The Bisulphide of Carbon Fallacy..36
TRACTION:—
The Sutro Railroad (Illustrated)...25
Electricity on the Brooklyn Bridge (Illustrated) 29
The Baldwin Westinghouse Electric Locomotive (Illustrated).....31
ELECTRO-ECONOMICS:—
Incandescent Lamp Efficiency by Lieut. W. Stuart-Smith, U. S. N. (Illustrated) 32
TELEPHONY:—
Experiences in Line Transposition..38
ELECTRO-THERAPEUTY:—
The Scientific Application of Electricity in Medicine, by W. N. Sherman, M. D., (Illustrated).....39
LITERATURE:—
Dynamo Electric Machinery, by Sylvanus P. Thompson, D. Sc....37
MISCELLANEOUS:—
Electric Elevator Regulation (Illustrated) 42
New Power Transmission Plants...28
The Portland Transmission Plant.44
PERSONAL 41
THE TRADE:—
A Railway Supply Center.....45
The New Fort Wayne Offices.....44
THE LAY PRESS:—
Popular Reflections of the Conditions and Prospects of Electrical Engineering on the Pacific Coast.46
REPORTS OF THE MONTH:—
Communication 47
Litigation 47
Incorporation 47
Transmission 47
Transportation 48
Illumination 49
Miscellaneous 50

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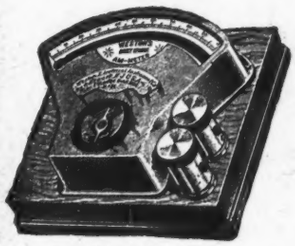

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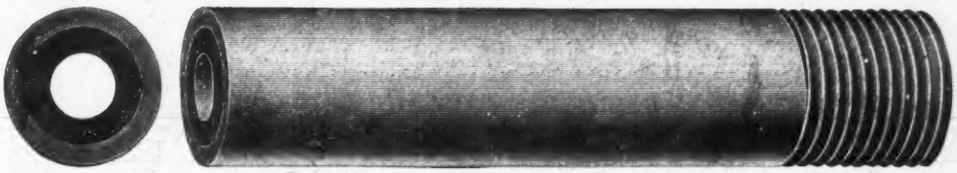

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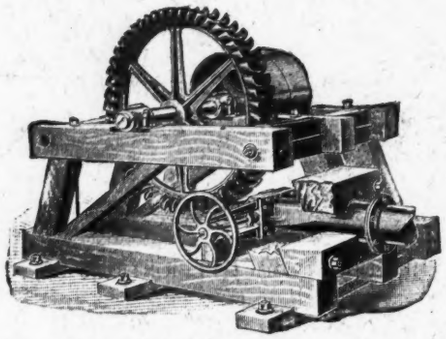

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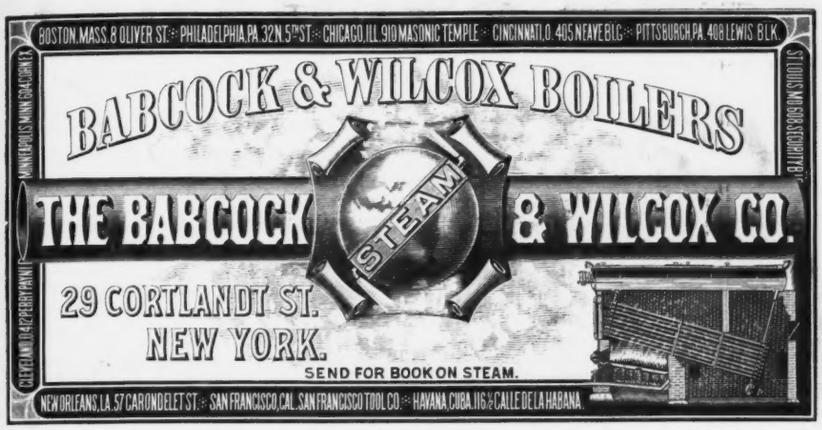
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ADVERTISERS' INDEX.

	PAGE
Abner Doble Company	iv
Alexander & Bro., Leo. E	xi
Askin & Cook	xv
Babcock & Wilcox	iii
Bolton & Strong	
Boudreaux Dynamo Brush Co	vi
Brooks & Co., J. W	vi, vii, viii, xi
Calfornia Electrical Works	x
Card Electric Motor and Dynamo Co.	—
Chemical Paint Co	xiii
Cobb, M. E., Edward S	iv
Cook Belting Co., H. N	viii
Dick Company, William	
Electrical Construction and Repair Co	
Electrical Engineering Company	xiii
For Sale Advertisements	iii
Fort Wayne Electric Corporation	xiv
Gamewell Fire Alarm Telegraph Co	xv
Girard Water Wheel Co	v
Gotterke & Low	vi
Helios Electric Company	x
Interior Conduit & Insulation Co	i
Johns Manufacturing Co., H. W	xiii
Kaufman, C. B., & Co	viii
Klein's Electrical Works, John M	ix
Lamont, G. E	ix
Leffel & Co., The Jas	v
Locke,, Fred M	
Martin, John	xi
Mica Insulator Co	viii
Munsell & Co., Eugene	vii
New York Insulated Wire Co., The	ix
Okonite Company, Ltd., The	i
Paraffine Paint Company, The	vii
Pelton Water Wheel Company, The	xv
Roger & Atwater	vii
Reisinger, Hugo	ix
Risdon Iron Works	ii
Roebling's Sons Company, The Jno. A	ii
San Francisco Typewriting Exchange	xiii
Sprout, E. E., Sydney	iv
Stanley Electric Manufacturing Co	xi
Stuart Smith, E. E., M. E., W	iv
Sterling Electric Supply Co., The	vi
Van der Naillen School of Electricity	v
Wagner Electric Manufacturing Co	x
Want Advertisements	v
Washburn & Moen Mfg. Co., The	xv
Wass D. D	ix
Westinghouse Electric & Mfg. Co	xii
Weston Electrical Instrument Co., The	i
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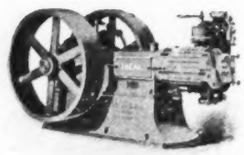

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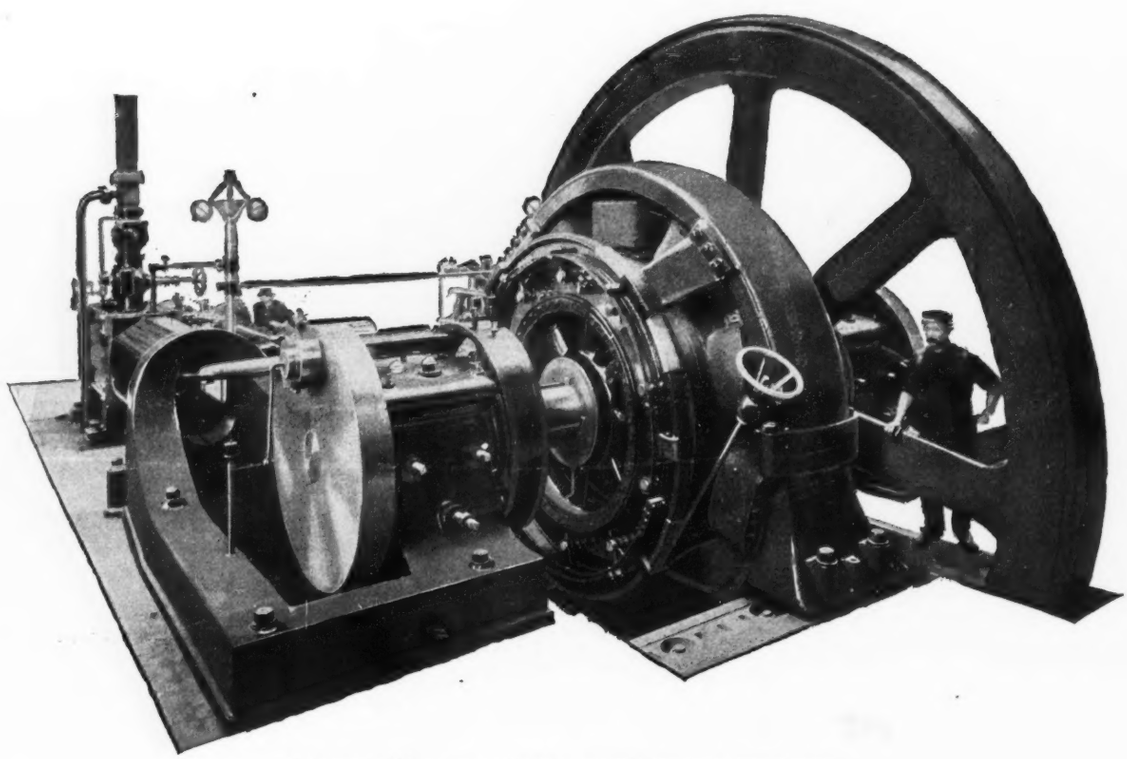

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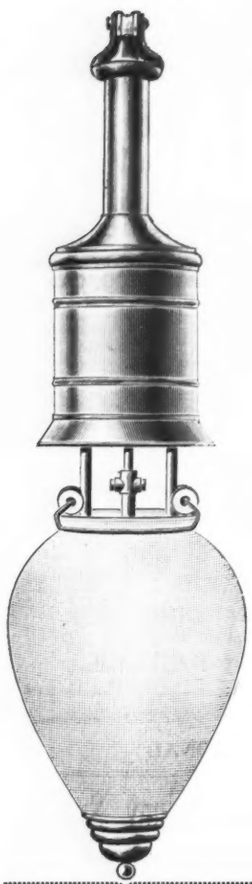

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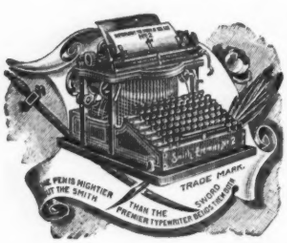

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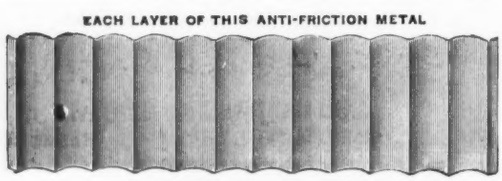

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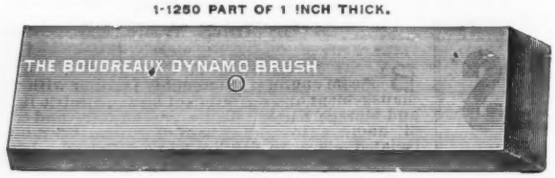

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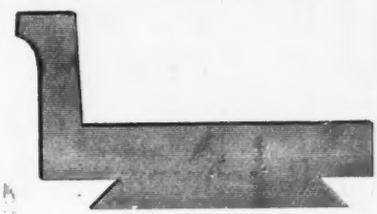

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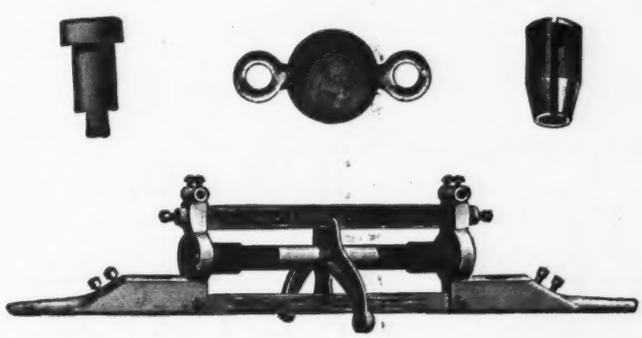

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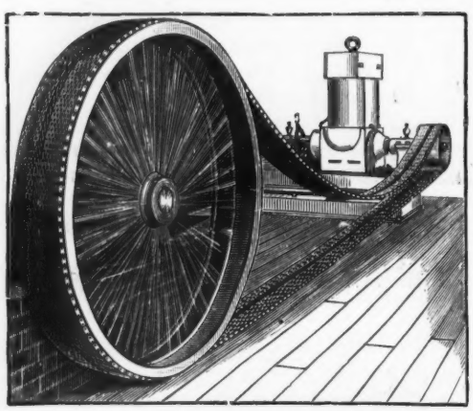

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The Journal of Electricity

VOL. II. FEBRUARY, 1896. No. 2

The Sutro Railroad

The Sutro railroad is popularly believed to have been built as the result of a disagreement between Adolph Sutro and C. P. Huntington over the fact that until the Sutro railroad became a certainty the street car lines controlled by Mr. Huntington persisted in maintaining a 10-cent fare to the Cliff House. Be this as it may, it is certain that Mr. Sutro had long cherished the idea of securing cheap transportation to the ocean beach with the hope that it might become the Mecca of the thousands whom he believed would appreciate the magnificent baths he had erected and the many other features of interest thereto to be found. Here may be seen, as nature's contribution, the world-famed seal rocks and a marine view that is unsurpassed, while the hand of man has made Sutro Heights a garden of beauty and has wrought novelties and attractions that will amuse every class, whether young or old, rich or poor. The Sutro baths are unequaled anywhere in point of size and magnificence, and while Mr. Sutro has spared neither money or effort in their perfection, he has found time to carry out engineering details of his own conception that prove unique and of great utility.

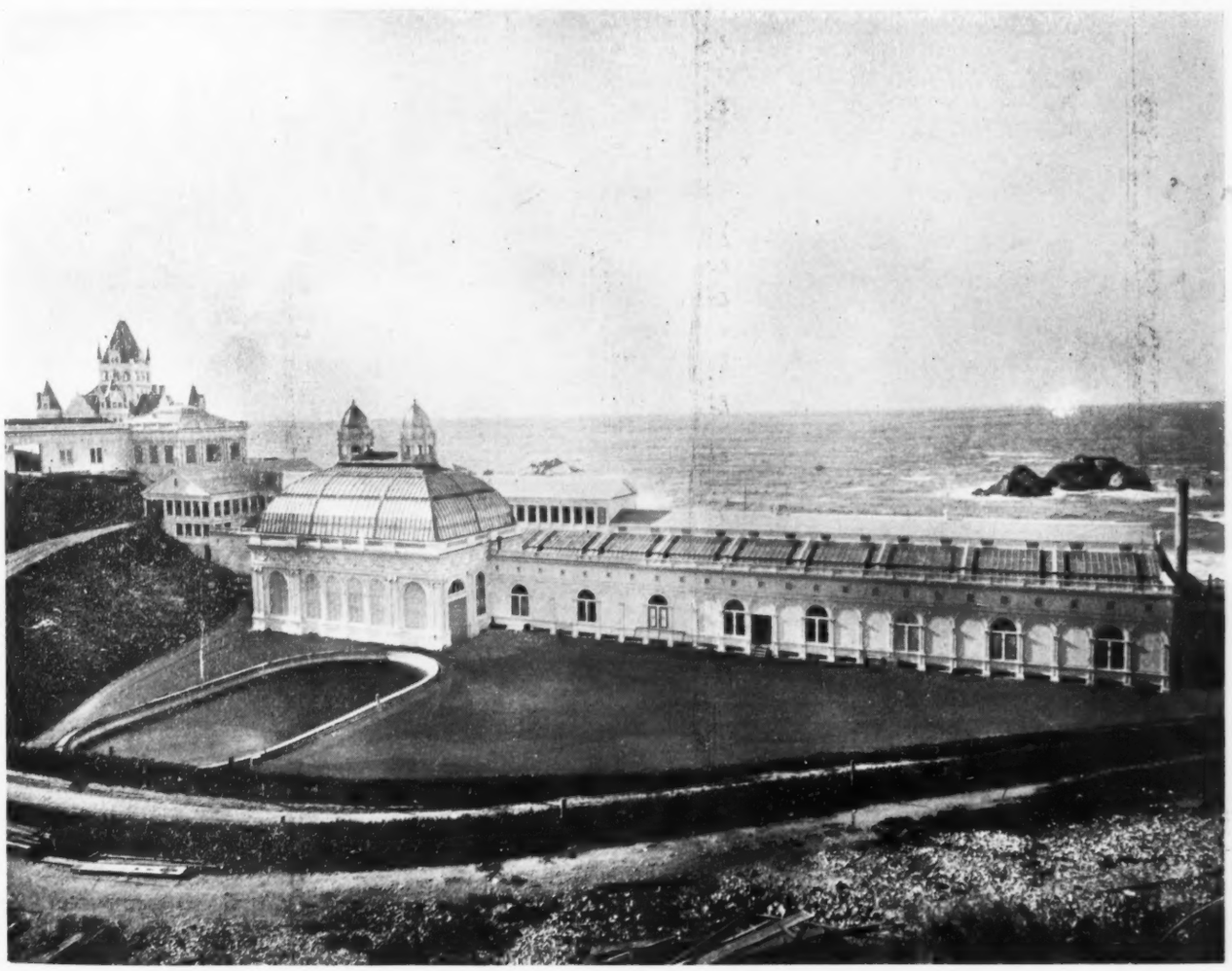

Photo by Taber FIGURE 1—THE GREAT BATHS AS SEEN FROM THE SUTRO RAILROAD.

The power house for the Sutro railroad adjoins the baths and a person standing in its doorway can easily toss a stone into the surf. The water for the baths is secured in a way that is decidedly novel. The baths are

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built in a crescent-shaped cove, upon one point of which stands the Cliff House, while the other point is a cape of rocks, perhaps 300 feet from the power house, that stands boldly into the sea. This cap has been tunnelled and its outer portion has been expanded into a basin cut out of the solid rock and of such an elevation above the water that each breaker dashing against the rocks forces its crest up and over the brink into the basin.

The situation therefore becomes an ideal one for the operation of condensing engines and it was a realization of this fact which led to locating the power house at this site. The gain in using the water thus obtained for condensers is two-fold in that it not only increases the engine efficiency, but that it also warms the water for the baths, and as the water from the catch basin is at a considerable head as stated, it is run by gravity

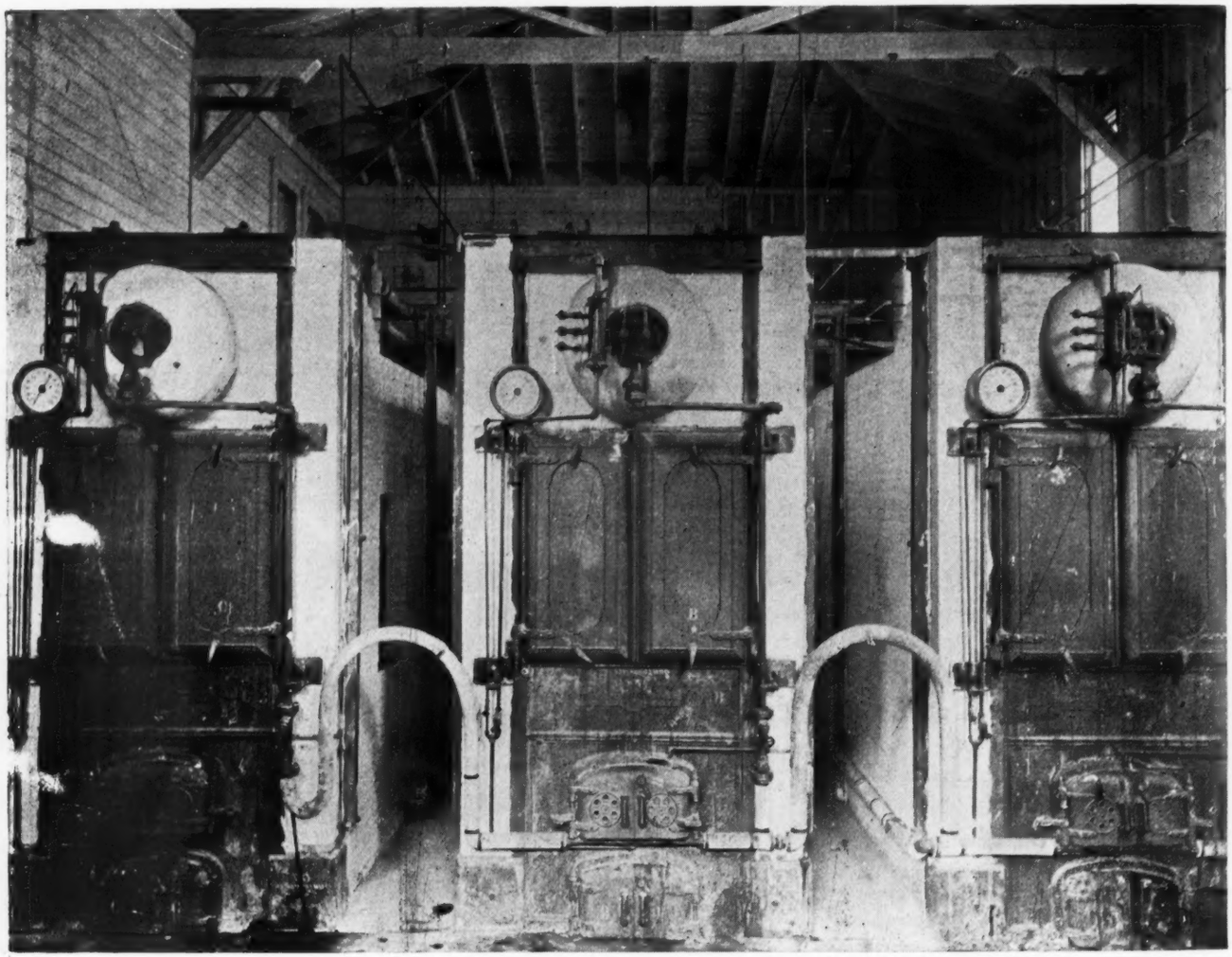


Photo by Taber FIGURE 2—BABCOCK & WILCOX BOILERS IN THE SUTRO RAILROAD.

The waves beat against the rocks at this point with unrelenting fury, for the point forms the south side at the entrance of Golden Gate and so heavy is the swell that it is estimated that some waves throw as much as 200,000 cubic yards of water into the catch basin. This water is perfectly clean, but oft times contains sand, to dispose of which the water is carried through the tunnel named and about 150 feet of masonry canals into a settling reservoir, where the sand settles and at low tide is drawn off from the bottom by means of sluice gates placed therein. The catch basin holds the water at an elevaton of twelve feet above high tide, which is sufficient head to supply the baths and allow the latter to be drained at low tide by gravity.

through the condensers into the baths and discharged from the tanks in the same manner.

Considerable interest is awakened in the visitor by the very perfect manner in which the immense swimming tanks in the baths are illuminated. This is done through the use of fifty General Incandescent inverted arc lamps, installed by the Abner Doble Company. These lamps are provided with reflectors and placed over the water at an elevation of about forty feet. The lights cast no shadows and so perfect is the illumination that the seams in the concrete work of the basins are clearly dis ernable through nine feet of salt water.

The power house contains one 400-kilowatt and one 200-kilowatt General Electric railway generators and

one 75-kilowatt multipolar 125-volt generator for operating the 1,200 incandescent lamps in the baths. These machines are all of the ordinary six-pole type and are driven by suitable verticle compound engines manufactured by the Fulton Engineering and Ship Building Works of San Fracisco. The boilers are fine examples of the Babcock & Wilcox Company's new wrought steel sectional water tube safety boilers, being made of

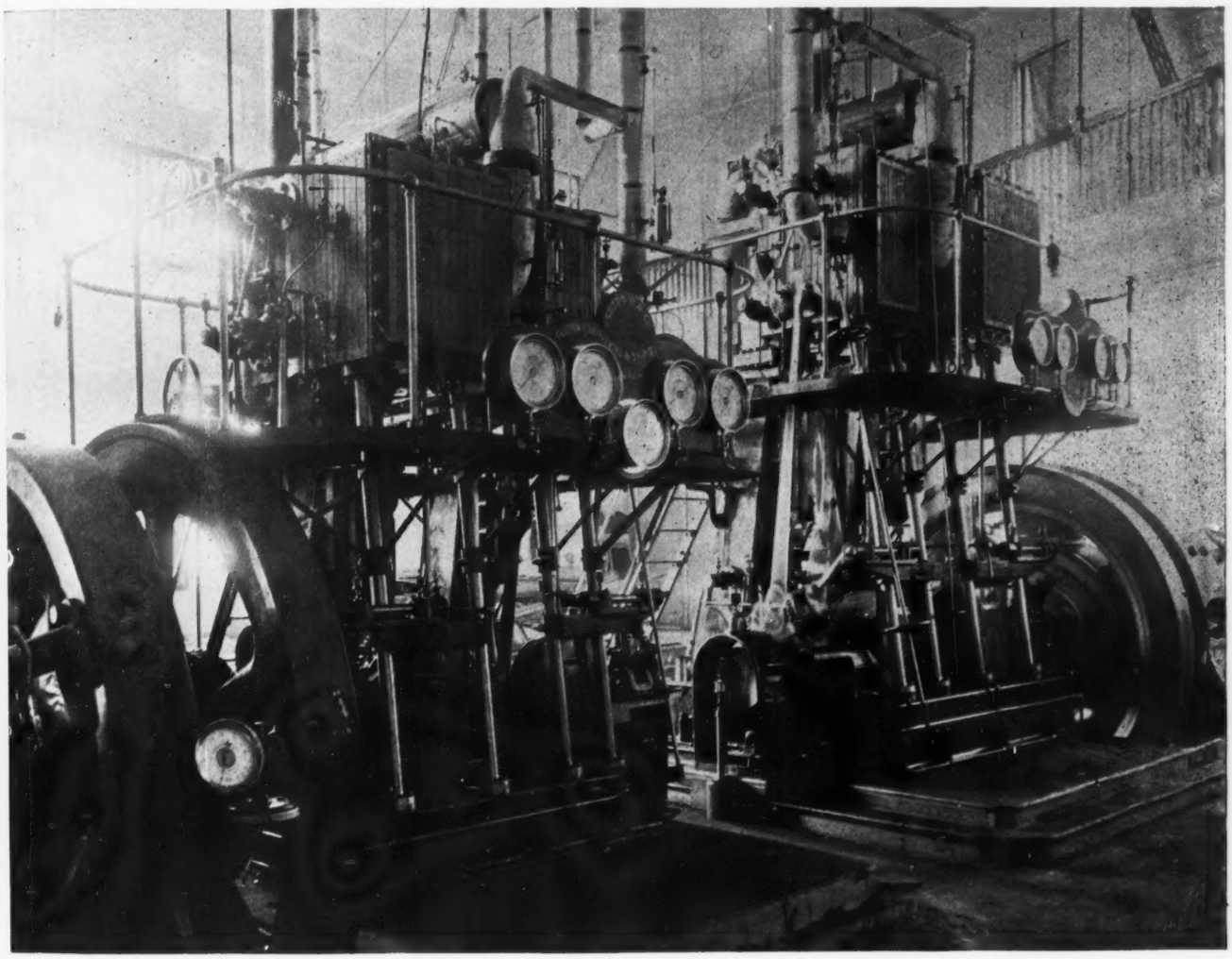


Photo by Taber. FIGURE 3—ENGINE ROOM OF THE SUTRO RAILROAD AND BATHS.

wrought steel throughout, while the steel forgings are simple and ingenious and differ from anything heretofore installed in San Francisco. As shown in the illustration each boiler has an independent setting, thus affording special facility and accessibility for inspection, in addition to which each boiler is perfectly independent of its own brick work, thus preventing the strain of expansion and contraction from being thrown upon the settings. The boilers are capable of withstanding a working pressure of 200 pounds per square inch with perfect safety and are withal of general superiority.

The railway equipment is generally of the Walker type, there being fifteen No. 10 double equipments, each of fifty horsepower. In addition, the Westinghouse Electric and Manufacturing Company has placed six type "12 A" twenty-five-horsepower equipments, while there have also been installed six "G. E. 800s." The Walker motors are all of the spring mounted suspension and series parallel controllers of the familiar forms are used with the exception that the road is to bear the distinction of being the first to be equipped with the new Walker three-barrel controller. The cars are of the double and combination type, and are thirty-seven feet in length over all, and eight feet wide. They are built in a most substantial manner with steel beams and are finished in ash and mahogany and plate glass. These cars are from the W. L. Holman car works of San Francisco and are the most attractive yet seen.

The only connection made by the Sutro railroad is that with the Sutter Street Railroad Company, whose cable lines are well distributed over the city. The Sutter street line terminates at Central avenue, where transfers are issued to the Sutro railroad and from this point the electric cars proceed out through Richmond to their destination over a line having a maximum grade of 10.5 per cent. Sixty-five-pound T rails are used

throughout and these are bonded by three laps of No. 60 wire. The track is of standard gauge and is carried on split redwood ties, well ballasted and tamped with crushed basalt rock with which the streets along which the line runs are built. A branch line three-quarters of a mile in length leaves the main line on Clement street and Eighth avenue and continues out the latter thoroughfare to Golden Gate Park, thus affording a park terminus for the Sutter street line.

Photo by Taber

Figure 4—Car Barn of the Sutro Railroad.

Those who frequented the California Midwinter International Exposition will recognize many of its attractions at the Cliff House, where may be found the Firth wheel, the mirror maze, the haunted swing and many other novelties of the Midway, all of which have been restored on the open ground above the baths. It is also understood that the electric tower is to be similarly restored at this place, while within the baths the spacious galleries have been filled with choice specimens of natural history that have been gathered by Mr. Sutro's agents in all parts of the world. Every comfort has been provided for guests, even to the extent of building the terminal station of the railway under the roof of the baths and the road throughout evinces careful consideration for the comfort and convenience of its patrons to an extent that is exemplary.

NEW POWER TRANSMISSION PLANTS.

The electrical equipment of the extensive cotton mills of the Pelzer Manufacturing Company, one of the largest cotton goods manufacturing concerns in the south, is rapidly nearing completion. The motive power is derived from Victor turbine water wheels driving 3 750 kilowatt three-phase generators, wound for 3,300 volts. The water wheels turn at a speed of 164 revolutions per minute. The electricity generated at the power house will be carried a distance of three and a half miles to Pelzer, where it will enter the mills and drive the following motors: One 400 horsepower synchronous motor wound for high potential, and three multiphase motors of varying capacities from 5 horsepower up to 110 horsepower. The majority of these motors will be of the inverted type, suspended from the ceiling in the different rooms. They will receive the current at a low potential from step-down transformers placed in the substation at the mills. The mills will also be lighted from the same circuit.

Traction

ELECTRICITY ON THE BROOKLYN BRIDGE.

The first official exhibition of electricity as applied to the switching of the cars on the Brooklyn bridge was made on February 8th. The motor car was coupled to three of the ordinary passenger cars and the train was switched from the incoming to the outgoing platforms and thence to the cable sheaves several times. The car was then taken over the complete bridge circuit twice, and complete satisfaction was expressed at the manner in which the work was performed.

The use of electricity in place of steam for switching the cars at either end of the Brooklyn bridge has been recognized as the only suitable method ever since the electric railway motor became a practical fact. But not until the motor had been adapted to heavy train service and had proved successful on the West Side Elevated road at Chicago, the Nantasket Beach division of the New York, New Haven & Hartford railroad and on the Baltimore & Ohio main line, did its employment in the bridge service become possible. Experiment is not a function of a municipal body, such as that governing the operation of the bridge, consequently it hesitated to apply electricity to bridge traction service, until it was

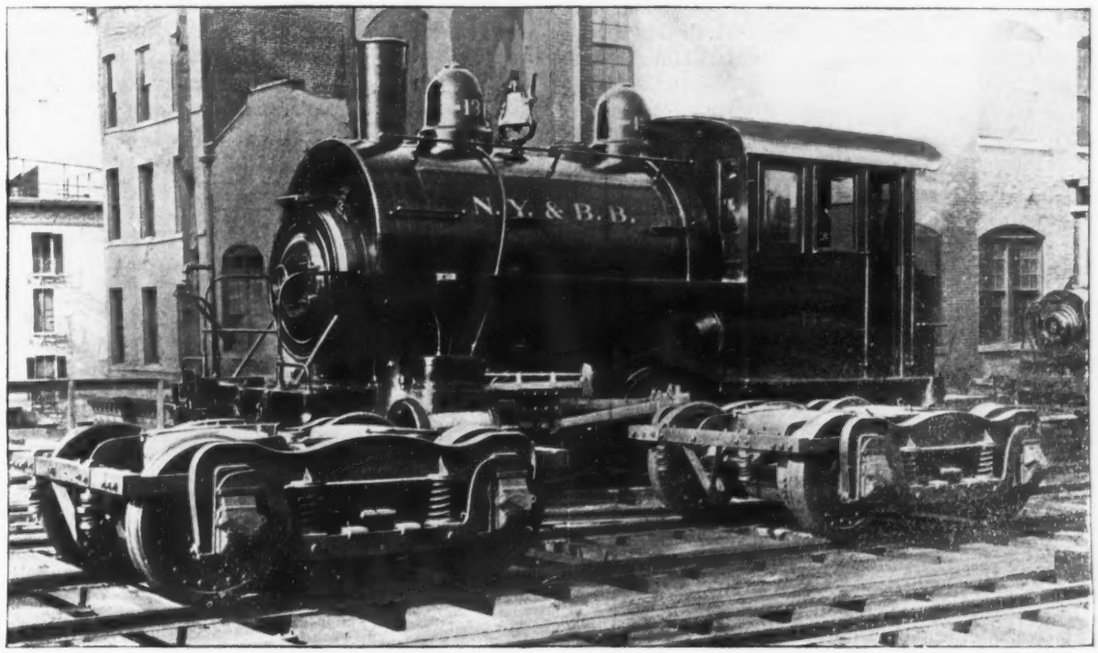


Figure 1—Electricity on the Brooklyn Bridge—The Old and the New Locomotives.

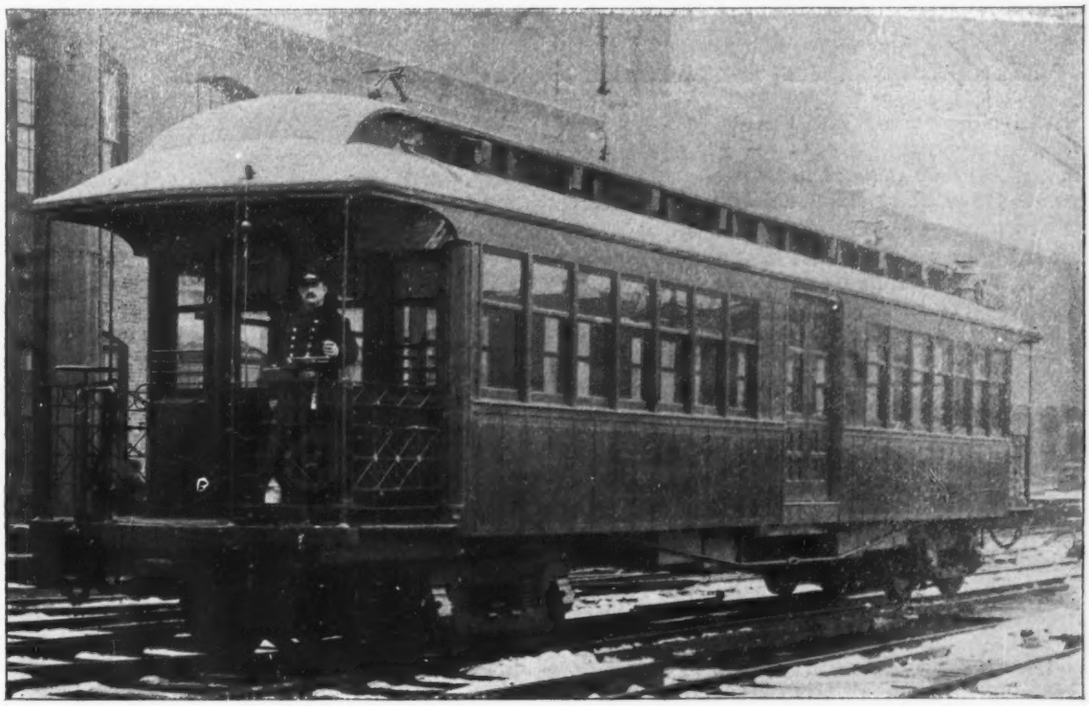


Figure 2—Electricity on the Brooklyn Bridge—The Electric Motor Car.

certain that if applied it would work without a hitch. The Chicago road has been running without a break of any kind since last June, the Nantasket Beach road was operated during the summer without the slightest trouble and the electric locomotives of the B. &. O. road have been conducting the entire freight service through the tunnel since the 2d of August last.

To enable the bridge trustees and the engineer the better to judge of the advantages which electric motive power might offer over the steam power hitherto employed for switching service, bids were called for the proposed electrical equipment, to which the General Electric Company responded, offering to fully equip one car, operate it for thirty days and at the end of that time, if the results were not satisfactory, to restore the car to its original condition and bear the cost of the experiment.

If the general plan adopted at first prove economical and satisfactory, a certain number of cars will be equipped with four motors, one on each axle. These motor cars will each remain with its own train at all times, switching it from the incoming to the outgoing tracks and pulling or pushing it over the tilting sheaves when the grips will take up the cable and the motors cease work. Should the grips slip while the train is mounting the 3.78 per cent grade the motors can assist the trains over the summit. Moreover, during the early morning hours, when traffic is light and the cable is not running the trains can be operated entirely by motor cars, as they are now by the steam locomotives. The eventual outcome will probably be the exclusive operation of the Bridge railroad by electric motor cars. Meanwhile they will switch the trains, and as each train is equipped with its own motor car, all the interference which the steam locomotives have hitherto placed in the way of the incoming and outgoing trains will be done away with and the complexity of the switching be greatly reduced. At present the time consumed in switching a train is twenty seconds and in that time a vast number of people gather on the platforms. With the new motor and the new principle of operation it is expected that passengers will at all times have cars waiting for them. Besides the gain in time in the switching process all the noise, smoke, steam and gases of the steam locomotive will be eliminated and this in itself will be no small gain.

One of the regular passenger cars of the Brooklyn Bridge has been selected to receive the first electrical equipment. All appartus, except the controlling handles and circuit breakers will be placed out of sight beneath the floor of the car. The ordinary light Pullman trucks and the cable grip mechanism have been removed, and as heavier trucks were necessary to carry the motors, they were supplied by the McGuire Company of Chicago, which combine the excellent features of passenger and locomotive trucks.

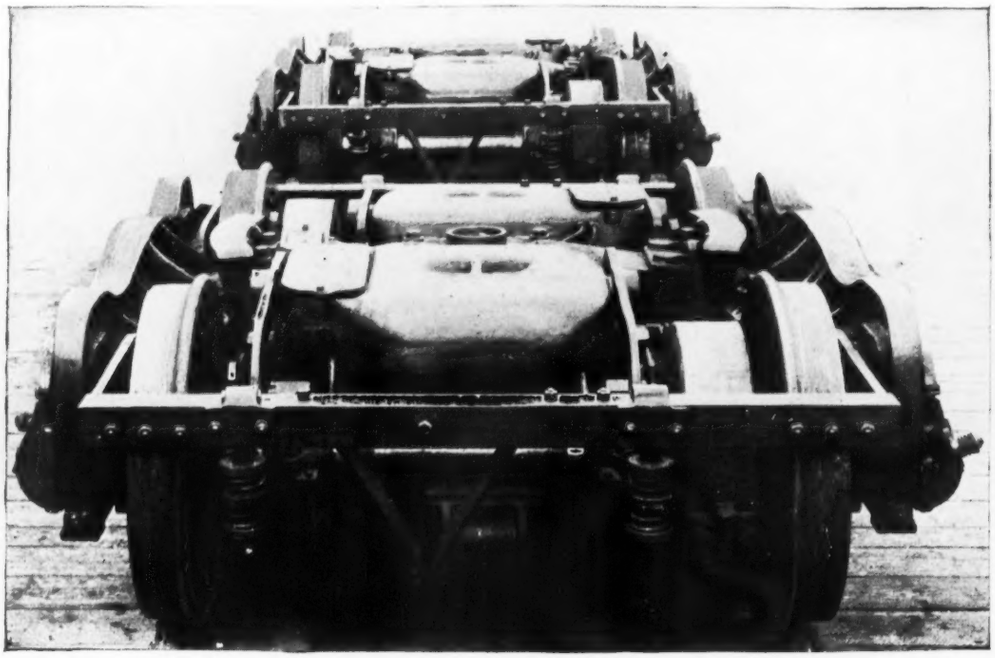


Figure 3—Electricity on the Brooklyn Bridge—Motor and Truck Mountings.

The general character of the motor equipment is similar to that in use on the Chicago Elevated and Nantasket Beach roads above mentioned. The motors are known as the "G. E. 1200," from the fact that under normal conditions each will exert a horizontal draw-bar effort of 1,200 pounds when mounted on a 33-inch wheel. Four of these motors are employed, one to each axle or two to each truck. They are completely incased and are water and dust tight. The armatures are of the well-known iron-clad type, the Eickmeyer windings used being sunk into slots in the armature core, which avoids the crossing of two wires of large difference of potential. The insulation is substantial and each segment of the commutator is of hard drawn copper. The armature is mounted on a sleve keyed to the shaft, which may be withdrawn without interefering with the armature structure. The field frame is of cast steel, and the ratio of reduction between the armature shaft pinion and the wheel gear is 3.5 to 1. Each motor weighs about three thousand pounds. With this equipment and the regular train a speed of about fifteen miles an hour may be obtained. Each motor is suspended on the truck from two trunnions in the upper field set in two bars, the outer ends of the bar

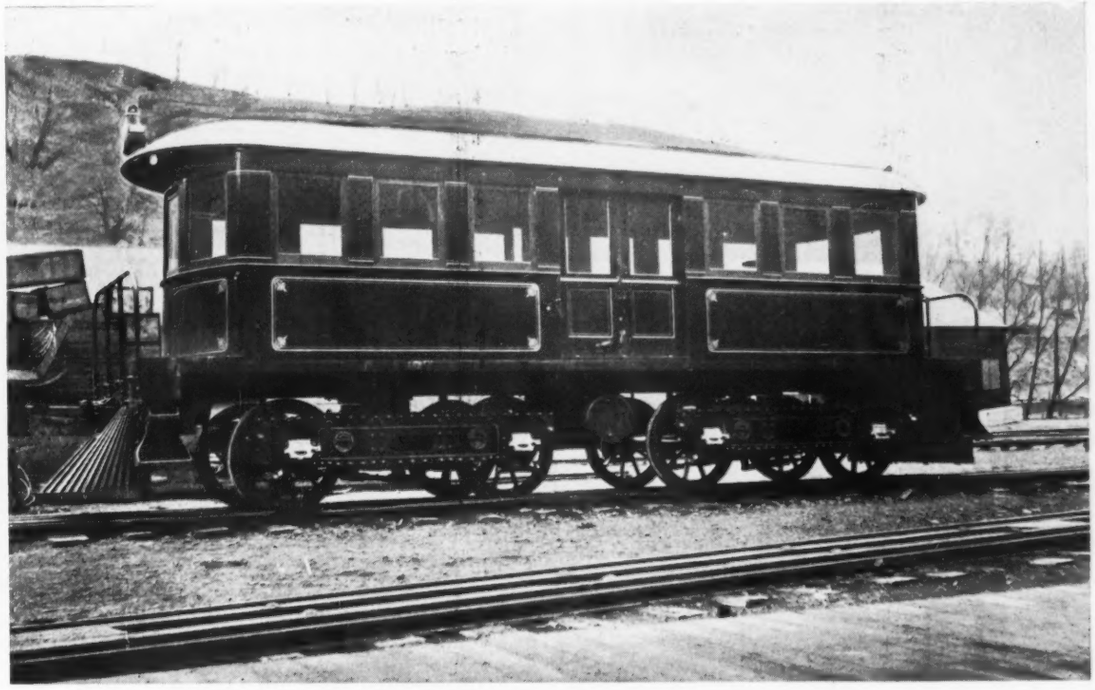
resting on eliptical springs, which relieves the axle of nearly all the weight of the motor. The controllers used are of the L 4 type, which have given such general satisfaction on the Chicago roads. The indicating dial of the controller is placed at the top of the platform rail and is lettered "series," "multiiple" and "off," showing exactly the position of the controller itself. The reversing handle is jointed and can be placed on or taken off the reversing switch spindle only when the controller handle points to the "off" position, showing that there is no current in the motors at that moment. The controller itself has no effect until the long arm of this jointed handle is dropped into the "forward" or "reversing" notches in the reversing handle plate. There are two controllers, each operated from its own platform and either controller will operate the four motors or any two of them as may be desired.

The resistance as well as the magnetic cutouts are placed beneath the car floor. Beneath each hood of the car is an automatic circuit breaker, placed within easy reach of the motorman. The operation of this device is instantaneous and is an effectual safeguard against any accident to the motor. Those circuit breakers take the place of the main circuit hood switches, but are wired in multiple with each other instead of in series. To guard against any possibility of one being closed while the motorman is at the other end of the car and desires to open the main circuit, only one handle is provided. The handle cannot be taken off without opening the circuit breaker and when removed the circuit is locked open. As the motorman must take the controller and circiut breaker handles with him when changing ends all danger of complication is avoided.

The collector, which will take the current from the overhead wire is a diamond-shaped frame of metal set longitudinally upon the roof of the car and carrying at right angles a bar in the center of which is a roller. The arms are wide enough to preclude any possility of missing contact. The diamond frame is depressable and expansible on the principle of the pantograph, allowing a play up and down to conform to the varying heights of the overhead wire. With this collector the trouble of reversing is entirely done away with. The power to run the car will be taken from the overhead wire already in position supplying current to the electric lights in the cars. The extra current, however, will be supplied from Fulton street feeder of the Kent avenue station of the Brooklyn City Railway, the return wire being connected to the rails of the surface road.

THE BALDWIN-WESTINGHOUSE ELECTRIC LOCOMOTIVES.

The Westinghouse Electric and Manufacturing Company has received the first electric locomotive manufactured under the arrangement entered into some time ago between the Westinghouse Company and the Baldwin Locomotive Works of Philadelphia. In appearance the locomotive is much different from the steam locomotive, and it also shows radical departures in construction from every electric locomotive hitherto manufactured. It is thirty-eight feet long and nine feet across. All the operating parts of the locomotive have been placed on the track and the body of the car will only contain controlling apparatus, and can be utilized as a receptacle for such appliances as are usually carried by any train. It may also be used as a freight or baggage car.



THE BALDIN-WESTINGHOUSE ELECTRIC LOCOMOTIVES.

One of the characteristic features of the locomtive is the truck, which has eight wheels and is constructed in a very substantial manner. The wheels are forty-two inches in diameter. There will be four motors of 200 horsepower each connected to the axles of the locomotive. Thus the entire weight of the locomotive will be placed upon the truck, thereby becoming available for adhesion. This feature of construction will be readily recognized as a very advantageous one over other locomotives, where only a small percentage of the weight is available for adhesion.

The locomotive completely equipped will weigh 160,000 pounds. The motors will be geared, which method has been decided upon so as to enable the company to use more efficient and durable motors and also greatly reduce the cost of the locomotive. It is stated that while the electric locomotive used in the Baltimore tunnel cost $50,000, the Baldwin-Westinghouse locomotive will cost less than one-third of that amount, and yet it will be able to accomplish the same work. The Baldwin-Westinghouse combination is constructing engines for all kinds of purposes. The one described here is the regular passenger engine, rated at 1,000 horsepower capacity. Then there will be locomotives made to be used in mines. The latter will have six driving wheels and the superstructure will consist of a sheet iron cab. The switching locomotive will also have a cab as a superstructure. There will also be manufactured locomotives for tunnel work, suburban traffic and rack locomotives, as well as for elevated railroads.

It is expected that within a few days the second locomotive, as completed by the Baldwin people, will be received at the East Pittsburg factory of the Westinghouse Electric and Manufacturing Company. This last one will be of the elevated railroad type and is an example of a motor car of the Manhattan Elevated Railroad of New York.

As far as the speed of these new locomotives is concerned, it may be stated that the motors have been geared to produce a speed of seventy-five miles an hour, although it may reach 125 miles an hour, if it were demanded. All Westinghouse-Baldwin locomotives will be equipped with air brakes, which will be operated in the usual manner by air pump underneath the car and which will be driven by an electric motor.

The Westinghouse-Baldwin locomotives have been designed so as to be utilized with any method of electric traction. They can be used with the trolley system, the third rail system, the Westinghouse electro-magnetic system, and they can also be utilized in connection with the Tesla polyphase system.

Since it has become known that the Baldwin-Westinghouse companies are constructing electric locomotives inquiries have come from all over the world for such machines, indicating the wonderful demand there is for such engines when they are manufactured by such well-known firms as the Baldwin Locomtive Works and the Westinghouse Electric and Manufacturing Company.

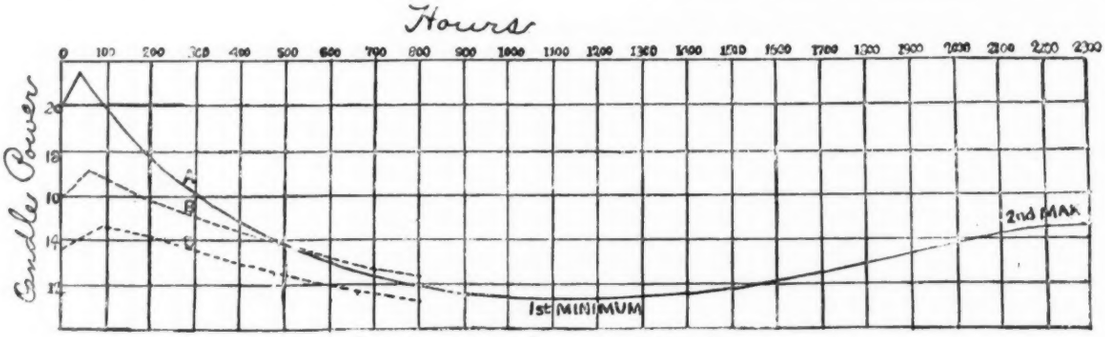
W. H. Preece, Electrician-in-Chief of the General Post Office of London, Eng., states that since the introduction of electric light at the General Post Office, the number of days of absence because of illness among the officials has ben reduced to two per annum for each individual, effecting a saving of no less than 3,000 days of work per year.

INCANDESCENT LAMP EFFICIENCY.

BY LIEUT. W. STUART-SMITH, U. S. N.

In a paper read before the American Institue of Electrical Engineers in 1893 Mr. Carl Hering said: "It is descent lamps to have a long life; the object of this paper is to show that this is a delusion and that it is not substantiated by facts, but on the contrary under normal conditions a very much shorter life represents an actual gain in dollars and cents." At the close of an able paper he says: "The results clearly show that it is absurd to keep lamps running too long and that the life of our present lamps is more than sufficiently good."

Of course Mr. Hering cannot be accused of advocating the idea that long life under any circumstances is bad, but his meaning is that while lamps are subject to their present infirmities such as rapid falling off in efficiency of filament as a light producing medium and rapid falling off in efficiency of the globe as a light transmitting medium (owing to blackening, etc.) it is folly to



INCANDESCENT LAMP EFFICIENCY.

attempt to retain them indefinitely on the active list to the detriment of a service, the efficiency of which would be increased by the more rapid promotion of the younger and more progressive lamps. It is, of course, desirable that the life be increased indefinitely, if the efficigenerally supposed that it is an advantage for incanency can be maintained and to this end much study and experiment has been given.

Considering the globe, there is evidently but one method of maintaining its efficiency, viz., by preventing any deposit which will interfere with free transmission of light. Considering the filament, there are manifestly two methods open, either of which will be effective; First, by preventing any removal of material from filament, by vaporization or otherwise, thus maintaining permanently the original surface; second, by causing the removal of material to be uniform over the entire surface, thereby keeping the character of the surface the same during the life of the filament. Maintaining the efficiency of the globe evidently depends upon the first method of maintaining the efficiency of the filament since if there is no removal of material from the filament there can be no deposit on the globe, also if such removal could be prevented the life would be indefinitely prolonged if there were no other forces operating to cause rupture. In practice the life of the filament would be limited by its ability to withstand the shock to which it is subjected each time a high e. m. f. is suddenly applied, but during the life the efficiency and candle power would remain unvariable.

It is not difficult to say what should be done to maintain the efficiency of the filament when either of the above methods is adopted, but how to do it is less readily explained. In order that filament may wear away

uniformly so as to maintain a surface of similar character throughout the life of the lamp it is requisite that the structure be asolutely homogeneous so that the tendency for vaporization to take place from one part will not be greater than from any other part. Vaporization takes place from the surface of all substances and at all temperatures, and in a confined space every substance is surrounded by an atmosphere of its own vapor. The density of this atmosphere is definite for every temperature and when once the space surrounding the substance is filled with vapor of the substance having the density due to the temperature, no further vaporization can take place unless the vapor density in the space be lowered by a portion depositing on the surrounding walls. In this case a further vaporization will take place and such vaporization and deposition will be continuous as long as there is a surface with which the vapor can come in contact, which is cooler than the surface of the substance undergoing vaporization. In an incandescent lamp having the globe in contact with the air, condensation of vapor must be rapid if it can come in contact with the glass as is usually, perhaps always, the case. It is generally supposed that carbon is a substance which vaporizes with the greatest difficulty and that under any circumstances the vapor density must be very small, but there is reason to believe that with the temperature attained by the filament vaporization takes place very freely and the vapor density in a burning lamp is comparatively great. Whether the removal of material is due to true vaporization, air wash or otherwise is immaterial; the appearance of the globe is sufficient evidence that removal does occur. True vaporization is probably the cause. If the filament is not homogeneous some portions must be more easily vaporized than others and this fact readily permits of an explanation for the falling off of efficiency. The light giving power of a hot substance depends upon the nature of the surface and for a given temperature the intensity of the illumination will vary with the surface. When the filament is heated to incandescence and begins to radiate light, vaporization takes place at rapid rate and if the material of the surface is uniform in its nature this vaporization will take place equally from the entire surface and the character of the surface, and hence the intensity of the illumination will remain constant if the temperature remains the same. If, however, the filaments are not homogenous vaporization will take place more rapidly from one point than from an adjacent point with result that small pits will be formed. At first these pits will not have a depth comparable with the length of light waves and the resulting roughness, by increasing the light-giving surface, might have the effect of increasing the candle power of the lamp in every direction except that normal to the surface of the filament. After a time, however, continued vaporization would cause some of the pits to have such dimensions that light radiated from the bottom would be half a wave length behind light radiated from the top, and destruction by interference would take place with resulting slight diminution of the intensity of the illumination. Experiments show that when lamps are first burned there is an increase in the illumination for some hours, due to a cause which is probably complex. When the loss by interference is equal to the gain from whatever causes are acting, the intensity of illumination will reach a maximum and a tangent to the curve will be horizontal; this continued unequal vaporization will cause a greater and greater number of points of interference to form with a resulting decrease in efficiency. As the process goes on the first pits formed will reach such a depth that the vibrations are no longer a half wave length apart and interference from these will diminish until finally when the depth is such that the vibrations are a full wave length apart the intensity of illumination at these points will be the same as at first. A continued operation of this kind will result in interference from a maximum number of points distributed over the surface and the efficiency will reach a minimum value, after which it will rise again to a second maximum, lower than the first since there will always be some points of interference.

Theoretically there should be a series of such maxima and minima, but the life of the filament is not sufficient to exhibit them. The accompanying curve illustrates this, it being taken from a former article by the writer, published in the Electrical World March 3, 1894. Manifestly if the filaments were absolutely homogeneous, though they would waste away and the candle power diminish, yet the surface would retain the same character and the efficiency would remain constant during the entire life. Of course the carbon uniformly removed would deposit on the globe and the efficiency of the lamp would fall. The production of uniform filaments, therefore, while beneficial, would not hold up the lamp efficiency unless at the same time vaporization was prevented.

It is impossible entirely to prevent vaporization from the filament because the ultimate vapor density of a substance in a confined space will always be the same, no matter what other vapors may be present, but in the presence of other vapors a longer period is required for the density due to the temperature to be attained, owing to the opposition offered by the other vapors to the free penetration of the new vapor into every portion of the space and proper advantage being taken of this fact may make it possible to prevent vaporization to a large degree. Manifestly condensation on the globe cannot be as rapid if other gases in the globe prevent a free passage of the carbon vapor from the filament into all parts of the space within the globe and to this extent any heavy vapor ought to be to some extent beneficial.

It is well known that some vapors tend to condense on the surface of glass, the vapor of water being a notable example, and it seems to the writer that some effect of this sort may e the true explanation of the action of bromine. If this vapor tended to condense on the glass so as to form a layer of considerable density the carbon vapor would impinge against it and be unable to penetrate it so as to reach the glass and be deposited. The layer of heavy vapor would be interposed as a comparatively impenetrable wall, which would keep back the carbon vapor. Deposition being thus largely prevented, when once the density of the carbon vapor reached the limit due to the temperature no further vaporization could take place except to make good the small amount which succeeded in getting through the gaseous wall. When the lamp was extinguished the vapor present would settle on to such places as were available and the next time the lamp was lighted there would be further vapor given off sufficient to fill the globe. This continuing, there would be some falling away in efficiency, but it would be slight compared with a lamp filled with a sustance which did not tend to condense on the glass.

If this view is correct the way to prevent vaporization and thus maintain both the filament and globe at a high state of efficiency is to make a careful study of various gases with reference to their behavior in presence of glass and introduce into the lamp such vapor as is found to form a layer of considerable density on the glass.

Berkeley, Cal., Feb. 28, 1896.

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EDITORIAL.

POLICY IN RAILWAY MANAGEMENT

The action of the Oakland, San Leandro & Haywards Electric Railway Company in conceding important points to the people of San Leandro without regard to their legal rights is an act of policy which should commend itself to the managers of all quasi-public works and especially those who have in their hands the formation of policy for electric railway enterprises. Every electric railroad depends for its earnings upon the good will of those resident near its line, even to a greater extent than is frequently acknowledged by those having charge of operating such tram lines. In some cases people are compelled to make use of cars whether they are favorably disposed towards the management of the road or not but in every case much traffic will be lost through ill will towards the management and an electric road needs to concede more to its patrons than is necessary in any other form of business. There have been throughout the country far too many bitter contests between railroad managers and the patrons of the roads, resulting in competing lines, expensive legal fights and in continuous loss of revenue; besides a running fight over the placing of poles, laying of tracks and the suspension of trolley wires, all of which elements effect the treasury of the road and all of which are the result in many cases of a needlessly independent attitude taken by the railroad management. The effect of the opposite policy is shown very clearly in a paper read before the National Street Railway Association by the superintendent of the Reading, Penn., Street Railway Company in which the author described the process by which this road which had for a long time remained an unprofitable property was thansformed into a paying investment, and solely by the means of so far earning the good-will of the inhabitants that the habit of riding on all occasions was acquired by the residents of the town.

It is not sufficient for an electric railroad to provide parks and concerts to which they may run excursion trains, for such entertainments must be continually varied and are a continual source of expense to the management, whereas the conciliation of those who are the natural patrons of the line obtains the most profitable and least expensive traffic, making the most profitone of the local institutions and supported strongly by local pride, which forms not one of the least important of the assets of the company.

ELECTRICITY IS NOT A CURE-ALL

Electrical engineers have applied their brains to the solution of so many problems in many fields and have been so successful in the main that they are often tempted to consider themselves capable of teaching the men of all other trades. A notable exception to this success is to be found in the recent "off-hand" attempts of some well-known electricians to suggest inventions of military devices. Within a few days of each other we have seen Mr. Edison and Mr. Martin describing their ideas of the application of electricity to warfare in articles which show only too plainly that these men have gone outside their province in attemtping to apply electricity to the art of destruction. It is hardly, at the present time, necessary to point out the absurdities in the plan of Edison since the attention it has received on both sides of the water has compelled all of our great inventor's friends to disclaim the idea of seriousness in his original communication.

The other proposition for defending the sea coast by the means of trolley road forts has not received the same notice but has about the same value and fails for much the same reasons that Mr. Edison's proposals were criticised. The idea of defending a long line of coast by the means of forts loaded on trolley cars apparently is based on the idea that warfare is only carried on against forts and neglects altogether the fact that while the moving fort might be engaged on one part of its line with a portion of a fleet another squadron could easily destroy the means of communication between the fort and its central station unless the coast was transformed into a continuous line of fortifications which would render the trolley road a useless addition to the expense.

We have here only another example of the wasteful folly that has led many electricians into advocating the solution of all problems by the application of electrical energy without their stopping to consider that they have responsibilities as engineers which should lead them to guard against unwarranted applications of electricity as well as to urge its use where such use may prove to be a financial economy. The outcry has been raised against the education of so many electricians, but so long as the electricians now practicing are incapable of understanding this fact that they should be first, wise men and wise engineers, and secondly, intelligent appliers of electric power, we will demand not a smaller number of electrical engineers but, on the contrary, a larger number of efficiently educated engineers.

THE MISSION OF JOURNALISM

One is often compelled to wonder whether the American technical or trade journal has a mission in existence beyond securing advertising patronage and the distribution of advertisements and even to wonder whether the mission of the simple distribution of advertisements is satisfactorily carried out by the editorial methods employed in furnishing reading matter. If such papers have a reason for their existence beyond that furnished by their utility in the cheaper distribution of advertising matter it seems certain that they should be thought of as furnishing a guide to engineers and purchasers as well as to investors in apparatus and engineering un-

dertakings which will reduce to a minimum the waste of time and money in foolish and impractical schemes. If their province, on the other hand, is simply that of the distribution of advertising matter their reading matter should be of such a character as to make the papers valuable to those who may purchase and for whose eyes the advertisements are intended; but when we look around us we are compelled to the conclusion that only a very few of the technical journals are attending to either of these needs. In another column we notice the publication of an article describing an invention which embodies a most egregious mechanical fallacy. The editors of the journal publishing this are known to have been thoroughly enough trained for them to have disclosed the impossibilities of the conclusions in the article they have printed, and yet they give no hint of its fallacies. Many of the articles we see from day to day are little more than abstractions from patent specifications of untried and probably inoperative apparatus, while the most earnest comment ever made is that " no doubt engineers will watch for further development,' never considering for an instant that it is to the editors of these journals that engineers should look for an honest criticism which may render unnecessary expensive and useless experimentation. The journals are daily multiplying in number to such an extent that advertisers are already beginning to look with suspicion upon their usefulness as mediums for distributing information, though such usefulness will not be once questioned where the advertiser is assured that the journal is read by electrical engineers and artizans for the information it contains and not simply by novices out of curiosity.

From every ground then, whether of selfishness or of morality we should appeal to the editors of all of our electrical journals for some opinions and more carefully obtained information and for less matter which bears so clearly the stamp both of the business office and of the untried mind.

THE IMPORT OF RONTGEN'S DISCOVERY

One of the most remarkable facts connected with the recent discovery of Professor Rontgen of the transparency of various mediums to a new form of electro-magnetic or light vibrations is the wide spread interest and the immedate appreciation of the value of the discovery. We have been accustomed to state that a scientific discovery was compelled to lie many years unapplied before its importance was appreciated by practical men, but at the present time we see a discovery in an entirely new field of scientific research brought to immediate practical usefulness. This is due not only to the character of this discovery and the ease with which it is applied, but not less to the fact that modern training includes so much scientific knowledge in the education of every man that the old distinction between the theorist and the practitioner has become gradually lost sight of and the best practitioner of the present day is considered to be the man who can make his practice conform most closely with recent advances in theory.

At the same time we are compelled to acknowledge that much of the information we have obtained of this discovery has filtered down to us through the unreliable source of the daily newspaper, and the sound advances that have been made have to be eliminated in every account we read from the additions of a vivid newspaper imagination. In every account we pick up we find descriptions of photography by the means of cathode rays, though Prof. Rontgen, in his original paper, considers his own discovery to be of a ray which is altogether dissimilar from the cathode ray, the properties and effects of which have been known since the time of Crookes and photography, by means of which was performed by Lenard over a year ago with results altogether dissimilar to the remarkable results of Rontgen.

It may be well here to enquire what is a cathode ray and how does it differ from the rays made use of in this most recent photographic method?

If while a tube of glass containing two metallic electrodes is being exhausted, a continuous electric discharge from a rapidly alternating high potential source of current be maintained between the terminals, we find that at first the tube begins to glow with a pale blue phosphorescent line marked off in distinct striations, the path of the light flowing from one electrode to the other through the tube in the shortest possible path. As exhaustion is made more complete the striae disappear and the seam of light proceeding from the positive electrode shoots forward in a straight line, while the space around the negative pole becomes completely black, though this space is not free from molecular action, as may be made apparent by placing in the path of the dark rays any material capable of flourescence, the effect being that the flourescent material will at once glow brightly. These dark rays are the cathode rays. Crookes and subsequent discoverers have proved that these rays may be easily deflected by a magnet, in that a thin sheet of aluminum or other metal will stop them almost completely, in that they are sufficiently energetic to heat a body placed in their path, or to turn a small wheel upon whose vanes they impinge. Not only are they incapable of passing through thick metals or other screens, but also they are completely eliminated by the presence of even a small amount of air, hydrogen or other gas. If now, while these cathode rays are being sent off from the negative electrode in the exhausted tube, they be allowed to impinge upon the glass containing walls, it will be found to glow in a bright flourescent spot, from which in the outside air the so-called "X" rays of Rontgen take their origin, being formed at the surface of the glass and transmitted not only through the air, but through all bodies in the inverse proportion to their densities. Unlike the cathode rays, they are not influenced by a magnet and not stopped by screens, and are not deflected by refraction, hence Professor Rontgen concludes, that he has discovered a vibration in the ether which is longitudinal and not transverse, as are the vibrations of light, as proved by Fresnel or electro-magnetic vibrations, as proved by Hertz. Should this conclusion of Professor Rontgen be borne out by subsequent experimentation, a most important addition to the electro-magnetic theory of light will be made and many of our ideas concerning specific inductive capacity and refractive indices must be altogether rearranged. To scientists this is even of more importance than the effects which have been already described in the photographic applications of these rays.

It may be proper to point out in conclusion that there is no doubt but that most of the illustrations heretofore published in the daily papers have been clearly manufactured in the newspaper offices with the exception of the photographed razor by A. C. Swinton, and the photographic sheet of Professor Wright of Yale. No clear photographs of skeletons or skeleton hands have ever been made; what has been done consists in showing outlines of the bones of the hand and feet as slightly darker than the outline of the flesh, though neither bones nor flesh appear as photographed in relief, but only as silhouettes in shadow.

Passing Comment

AN EDITORIAL REVIEW OF CURRENT EVENTS AND THE PUBLICATIONS OF CONTEMPORARIES.

THE INFLUENCE OF TROLLIES ON TELEPHONES.

Some very surprising conclusions are reached in an article by C. S. Du Riche Preller in the London "Electrician" of January 10th on the telephone disturbances produced by electric tramways, in which he states, from experiments performed on no less than six Swiss tramways operating under reasonably similar conditions so far as telephone lines are concerned, that the greatest disturbances of telephonic communication takes place where the American trolley wheel is used and the least where the sliding shoe contact or the Simens-Halske contact arm is employed. These conclusions are explained by the author as being due to the fact that in the ordinary wheel trolley construction numerous contacts are required for keeping the trolley line in the center of the track, and these contacts are so made that jumping of the wheel takes place with consequent flashings and surgings of the current made evident by inductive disturbances. With the contact arm and the sliding shoe, on the other hand, the supports are not so numerous and are so soldered that a perfectly smooth surface is offered by the wire for the passage of the contact which does not jump and scrape entailing consequent surgings of the current. These conclusions are surely worthy of careful consideration and careful experimentation though the experience we have already gained does not seem to bear out the conclusions entirely. Listening to a telephone in which there is inductive disturbance from a long suburban line running few cars, one can readily distinguish between flashings at switches or trolley supports and the continuous singing of the motor while the trolley is running along the smooth wires. This would indicate that either there is a continuous jumping of the trolley wheel or that the disturbance is due to the variations in the current altogether independent of the trolley contact. From certain references to noises made by the cars and the trolley wheels in these experiments of Preller one would come to the conclusion that the author had been experimenting with better motor machinery where the sliding shoe was used than where the contact wheel was employed, which may possibly account for a portion of the difference in the disturbance noted. If, now, experiments should bear out these conclusions which we have here noted a very important step will have been taken in the question of the ownership of the underrunning trolley patent since it will be proved to be not the only system of contact but even to be not the best system for general use.

TRADE CATALOGUES AS BOOKS OF REFERENCE.

The question of trade catalogue manufacture and preservation is well discussed in articles printed in the "India Rubber World" of January 10th and in the February number of the "Engineering Magazine," and it is hoped that by a continuous agitation of this subject some of the confusion now obtaining in this matter may be reduced. At the present time those who are issuing trade catalogues seem to make them as eccentric as possible with the idea that they will serve something of the purpose of a bill board poster, and for the first hasty glance this may be the purpose served by eccentricities of form. Beyond this first glance the trade catalogue should have an importance as a book of reference and be as easily handled and preserved as any other book of refence in a man's library. When this is true the catalogue is likely to be preserved and kept constantly before the intending purchaser, but when the catalogue of eccentric form is received and will not stand properly on any bookshelf or lie easily in any ordinary filing case, the catalogue is apt either to be consigned to the waste basket or to a pile of neglected papers, journals and other such publications. The writer in the "Engineering Magazine" describes a method of preserving catalogues in ordinary letter filing cases about 10x12 inches square which may be indexed and otherwise handled as a letter file or pamphlet box, but when we consider how many of the really valuable catalogues we are daily receiving that cannot be preserved in this manner we see how great a mistake is being made by those who issue these books. Trade catalogues are items of great importance and expense to manufacturers and are capable of yielding a desirable form of advertisement not only by including in the text information which is too valuable to destroy but by presenting the catalogues themselves in such form as to make them easily preserved and to render them essentially parts of a business man's library.

So long as the printers control this business just so long will the eccentricities of form be continued, but when the manufacturers begin to consider the needs of the users of their catalogues they will at once see the need for making the catalogue easily preserved and readily available for reference.

THE BISULPHIDE OF CARBON FALLACY.

So long as men will devote their time and money to the solution of the problem of perpetual motion it is perhaps not surprising to find that less apparent mechanical fallacies deceive those who are fairly well educated and reasonably conversant with mechanical principles, but one does not look for such denseness amongst the editors of our best electrical journals, and yet the "Electrical Engineer," in its issue of January 1st, devotes more than a page to an elaborate description of a carbon biculphide engine which repeats again persistent mechanical fallacies. It is true that this curious fallacy has never been more alluringly presented or with a greater show of apparent efficiency since the bisulphide of carbon is itself heated in a steam bath, the pressure of which will not run the engine driven by the bisuphide of carbon vapor, and under the conditions described in the article there is no doubt but that a greater efficiency is obtained from the use of the bisulphide of carbon vapor than from the use of steam direct from the boiler described. This plan depends for its illusiveness upon the fact that the pressure of the bisulphide of carbon is greater than the pressure of water vapor for a given temperature and in consequence the temperature of the exhaust from the bisulphide of carbon engine may be considerably lower than the temperature of the exhaust of a steam engine; consequently at low initial temperatures the possible working range is greater with the volatile bisulphide of carbon than is possible with steam, but when we attempt to increase the upper temperature limit as in modern steam engine practice the pressure of the bisulphide vapor becomes uncontrollable and in consequence the efficiency of the vapor cannot be insreased to so high a limit as is possible with water vapor by increasing the initial temperature of the steam. Since bisulphide of carbon is a gas at a temperature slightly above the ordinary temperature of the air the range of temperature can be greater in its use than is possible with steam at the same initial tem-

perature and by lowering the value of T_2 in the efficiency formula $\frac{T_1-T_2}{T_1}$ we increase the efficiency of the working fluid, but as we have pointed out it is impossible to use this gas at the maximum values of T, which are obtainable with steam and in consequence the efficiency of the bisulphide of carbon engine must be necessarily small as compared with steam engines as they are used in practice, though it may be greater than the efficiency of a steam engine using water vapor at 25 pounds pressure as describel in this article.

Furthermore, direct heat cannot be applied safely to a bisulphide of carbon boiler and in consequence loss of heat conduction takes place which is far greater than under the ordinary circumstances of a steam generating plant. As we have stated, the fallacy is very ingeniously concealed in the description of this apparatus, but no one who understands the principles of the working of steam or the efficiency of the steam engine can fail to detect the very apparent fallacy in the plan and the inevitable loss of energy in this means of heat transformation.

Literature.

DYNAMO ELECTRIC MACHINERY. By Silvanus P. Thompson, D. Sc.; fifth edition, revised; pp. 835; 19 plates. New York: Spon & Chamberlain. Price, $5.50.

Since the publication of Professor Thompson's Dynamo Electric Machinery this book has been considered by students and electricians in general to be the standard authority upon dynamo machine design and the various editions have from time to time indicated the progress of the art and theory of dynamo electric machinery. The arrangement and origin of the book, however demands inquiry concerning its comparative availability as a text book and as an engineer's manual. As a text book the vast amount of matter included requires a very extended course for its complete reading and the manner of statement of the various propositions throughout the book requires often a very thorough understanding so that the student should devote a considerable time to collateral reading in order to obtain a complete knowledge of its many theoretical propositions, at the same time the manner in which the subject has been presented by the author leading to the complete theory of each part of the dynamo machine by successive easy steps makes the treatise one most easily read by elementary students and, where the necessary time is availale for so complete a study of the subject, the teacher can hardly choose a better work as a text book.

Considering the book as a manual for engineers we find expressed in it the complete and accepted theory of the design of the dynamo electric machinery given in a manner which is at the same time concise, clear and devoid of intricate theoretical considerations. The main types of construction are elaborated in detail whether of a mechanical or electrical nature, or whether concerning the details of armature of commutator or field magnets. At the same time the arrangement of the book in progressive chapters which we have spoken of as an advantage from the student's standpoint, makes the work an exceedingly difficult book when used solely for reference. The effect of this arrangement may be at once seen by a glance through the table of contents in which from six to ten references extending through the entire book are given for every important detail of construction. This, however, is indeed not a great objection when one is completely familiar with the contents of the book and of its arrangement but which, as stated, renders it unfit for use solely as a manual for reference. In some of the earlier editions, particularly the third, methods of construction and of regulation in dynamo electric machinery where described and advocated which were unsuitable for practical use and in some cases were impossible to realize, but in striking contrast we find all of such matter has been carefully removed from this fifth edition and throughout the entire work the student always remains upon sure ground and learns the theory and method of construction which have been proved to be applicable in practical cases a change that has vastly enhanced the value of the work while reducing its bulkiness by extracting matter of doubtful utility. It is with regret, however, that we notice the contraction of the chapters devoted to magnetic principles and the magnetic circuit since this contraction has reduced the formula for calculation of field magnets to too nearly the class of "Rules of thumb" unless the student is either capable of supplementing the work on his own account and follows an extended course including not only the elements of electricity and magnetism but also the author's work upon the electromagnet. The reductions in these chapters and similar reductions in corresponding parts of the book constitute the most important differences between the fifth and fourth editions until we reach the portion devoted to alternate current machinery which has been much extended and rendered more clear by use of the theory of alternate currents as developed mainly by Kapp, Bedell and Crehore and Steinmetz. This section, which is devoted to the exposition of the alternate current transformer, the synchronous motor and the asynchronous motor, while being little more than a sketch of the subject, is sufficiently clear to be understood by those students whose mathematical and physical courses have included only elementary studies which is noted with a great deal of satisfaction not only on account of the fact that a book has been written which presents the elements of alternate current working so clearly that they can be understood by elementary students but also for the reason that it is gratifying to find the theory of alternate currents so far developed as to be clear in the minds of those who have made an extended study of the subject. This is a state of knowledge which has only been reached within the last two or three years.

It is noticed with regret that the author has adhered in this new edition as well as in the recent edition of the "Lessons in Electricity and Magnetism," to the notation adopted in a haphazard manner before that of Hospitalier received general sanction and surely the chances demanded by this new notation are at once so slight and so important as to be concurred in without dispute by writers in general. It is therefore regretable that Professor Thompson has not lent the weight of his authority to the new system especially at this time when he is rewriting all of his important books and could have most readily made the change.

On the whole, this fifth edition of Dynamo Electric Machinery. when compared to the four previous editions shows that the art of the design of such machinery has finally attained a fixed condition and that the theory of dynamo electric machinery design may be presented clearly and in a manner available both to the student and to the engineer.

M. L. B. Pemberton, well known from his long association with the Los Angeles Consolidated Street Railway Company as chief electrician, has opened an office in Los Angeles as consulting and supervising electrical engineer.

Telephony

EXPERIENCES IN LINE TRANSPOSITION.

The art of transposing telphone circuits paralleling high potential transmission lines in order to avoid induction from the latter is now so well understood by electrical engineers that the problem of securing a "quiet" line is no longer one carrying hesitation if not dismay at its suggestion, yet with all the progress that has been made along this line there yet arises almost daily a demand for information regarding the means employed for overcoming what at one time seemed to constitute an almost insuperable barrier to the operation of telephone lines over distances susceptible to induction from high pressure transmission circuits, arc lighting circuits and even from railway systems. Alternating systems exercise such marked influences over all telephone lines in their immediate vicinity after their introduction the necessity for at once abandoning grounded telephone circuits became manifest, but when this had been done the evil became lessened but slightly, and to overcome which the method of transposition now practiced so generally was devised. It is with a view of describing the means for achieving quiet telephonic communication under these adverse conditions that the experiences derived in and about Portland, Or., are here related. This locality is selected above all others on the Coast for the reason that the conditions there existing are not only the first calling for the exercise of originality in devising means for obviating induction, but also because of the fact that there are found all the various systems with which the telephone engineer has to deal. Readers of "The Journal of Electricity" will recall a description of the transmission plant of the Portland General Electric Company appearing in the issue of December last, and in which was pointed out that the company named obtains power from the Falls of the Willamette river at Oregon City, about fourteen miles distant, where are located two stations, station A being on the east bank of the river and containing about 12,000 lamps capacity of Westinghouse, 4,000-volt incandescent high frequency machines operated at 16,000 alternations per minute and 1,100 lamp capacity of Excelsior arc lighting dynamos, at 5,000 volts, besides a miscellaneous assortment of other machines, while station B, on the west side of the river, contains three-phase General Electric generators delivering current to line at 6,000 volts. Almost the entire output of station A is carried across the river, over the suspension bridge about half a mile below the falls, whence it continues to Portland along the west bank of the river, but several arc and incandescent circuits are carried on down the east side to the sub-station in East Portland for local delivery. In addition, the line of the East Side Railway Company runs from Portland to Oregon City, almost paralleling the transmission circuits referred to.

The original telephone line existing when station A was put in operation was of No. 12 iron wire, located on the pole line of the local telephone company, probably one-quarter of a mile from the transmission line. This circuit was used as a grounded line and owing to the number of telephone stations it included was of high resistance, and as would now be known, it proved to be so noisy as to be entirely useless at night, although it rendered good service by day when the incandescent service was not in operation.

The Willamette Falls Electric Company, which then owned the plant, next erected a new metallic circuit on the electric light poles, which was put up without transposition and, like its predecessor, it proved to be worthless except for signalling by bell. Various means were adopted to render this circuit serviceable and experiments in this direction even went so far as to fit each cross arm, carrying a transmission circuit with grounded small copper wires so that any leakage might at once be taken to earth, but the trouble was found to be more deeply rooted than mere leakage effects. Finally, however, the telephone circuit was transposed originally at every half mile, which showed an improvement. The number of transpositions were then increased from time to time until at last the circuit was brought to that condition when it was useful so long as direct currents were on the transmission line, but alternating currents still proved troublesome. Shortly afterward the company installed a Westinghouse arc lighting system, which proved to be the noisiest circuit yet encountered and which therefore rendered telephoning impossible.

As stated in the article referred to the company is now using a six-pair lead cable, which is suspended in the center of the pole line. The conductors are in twisted pairs and except for miner mechanical troubles the service has given perfect satisfaction and the line, though humming slightly, permits conversation to be carried on with ease. This cable is over thirteen miles in length, which constitutes one of the longest aerial cables in use. The original metalic circuit telephone line is now used for signalling purposes exclusively.

The first experience of the Oregon Telephone and Telegraph Company in the construction of telephone lines paralleling transmission circuits since the abandoning of grounded telephone circuits was in building a private line to the Palatine Hill reservoir of the Portland Water Company, five miles from Portland on the west side of the river. The line was of No. 13 galvanized iron wire, was supported on single petticoat glass insulators and was transposed every 300 feet, the method used being the simple horizontal transposition. The line proved to be unusually quiet. The next line that was built was transposed every 1,200 feet and was found to be about as noisy as the average city line. Shortly after the River View cemetery line was built paralleling the transmission circuits about a quarter of a mile distant. This line is transposed every 600 feet and while it is three and a quarter miles long it is very quiet.

On the east side of the river the long distance circuit of the Sunset Telephone and Telegraph Company parallels the 4000-volt alternating and 5000-volt arc lines of about two miles and are separated from the latter by only twenty feet. Originally the telephone lines were transposed every 1,500 feet, but they proved to be noisy and the transposition was cut down to 600 feet with satisfactory results. These telephone cricuits are of No. 8 bare copper and continue on for more than 100 miles and no inconvenience is suffered from induction. The poles on the east side railway are 100 feet apart and the private telephone line built by that company along these poles was first transposed at every tenth pole and as the road is over ten miles in length the telephones were very noisy, to remedy which Mr. James Curran of the telephone company advised that the transposition be reduced to every eight or every four poles as might be necessary. This advise was carried out by transposing at every fourth pole, when quiet was obtained. As the telephone lines had originally been transposed at every tenth pole and as it is preferable that the length of transposition should be even, the experience of the east

side company emphasizes the advisability of facilitating increased transposition by transposing at only such poles as are in arithmetical progression, viz: poles numbered 2, 4, 8, 16, etc.

No trouble whatever has been experienced by induction from the three-phase system. A single exception to this occurred in one instance, however, when one side of the three-phase line became grounded, and at once every instrument within reach became so noisy as to preclude any possibility of use—this despite the fact that all instruments are on metalic circuits. The impracticability of endeavoring to offset any leakage that may occur on the transmission lines through the means of balancing coils, etc., has also been demonstrated, and although only the horizontal plan of transposition on the same cross arms from end is used, the results obtained have been eminently satisfactory.

Electro-Therapeuty

THE SCIENTIFIC APPLICATION OF ELECTRICITY IN MEDICINE.

BY W. N. SHERMAN, M. D.

While electricity has long been used as a remedial agent, yet its marvelous power attracted the attention of many charlatans and imposters, who made use of it to impose upon the credulous; therefore scientists, loth to be classed with humbugs, refrained from giving serious attention to its development. The recent great advances of this subtle force as a therapeutic measure has kept pace with electrical development in other lines. Instruments have been perfected and are now used by practical physicians in their daily work and there is now a more uniform standard of measurement which enables workers to compare results. We have at our command a number of currents from which to select, and it requires judgment and skill to be able always to select the most suitable one for each particular case and to decide whether static insulation, breeze or sparks, the static induced current, the galvanic, the faradic or the sinusoidal is the most useful. Electro-therapeutics has suffered through the ignorance and the improper methods and instruments used in its application. Even at the present time some of our electrically inexperienced brethren call us cranks and electricity a "fad," but we realize that the time is rapidly approaching when they must feel their incompetency by not knowing and using this valuable therapeutic agent.

In the consideration of this subject there are two important facts that should be kept in mind in order to clearly comprehend the object and uses of the various electrodes and instruments used. The first is, that the human body, particularly the skin, offers great resistance to the electric current, and, second, that we are dealing with the fractions of an ampere, instead of the ampere. The voltage of a stationary office battery should be from 60 to 100 volts, while that of the portable battery is from 25 to 50 volts.

Formerly, when electro-therapeutics was not so well understood or so scientifically applied the ampere and the volt were ignored, the operator being guided by the number of cells and the sensations of the patient. Even today some who use electricity hold to this old method. At present the tendency is to use the total current strength of the battery, placing resistance in circuit in the form of some of the valuable rheostats or current controllers made for this purpose, which ordinarily do not reduce the voltage but reduce the current. I shall mention the exceptions to this rule further on. The source of the current for medical use is generally the open circuit cells of the sal-ammonia type, forty to sixty of which are connected in series. The portable galvanic battery consists of primary zinc-carbon cells, twelve to twenty-four of which are connected in series, and when not in use remain outside the exciting fluid to prevent waste and polarization. These batteries require constant and intelligent attention to keep them in perfect working order, while those first mentioned require little attention, and need recharging about once a year.

Rheostats for controlling the current are made in various forms, the best of which are the Massey current controller, the Jewell rheostat and the Vetter current controller. The Massey rheostat is composed of a circular piece of marble over which moves a radial arm, having a metal brush contact at its outer end which moves over a thin layer of graphite, which being the resisting substance can, when worn away, be renewed with any ordinary soft lead pencil. This instrument is very serviceable for electro-therapeutic work and a great favorite with many. The current can be controlled to a nicety, and it may be used on a 110-volt dynamo circuit.

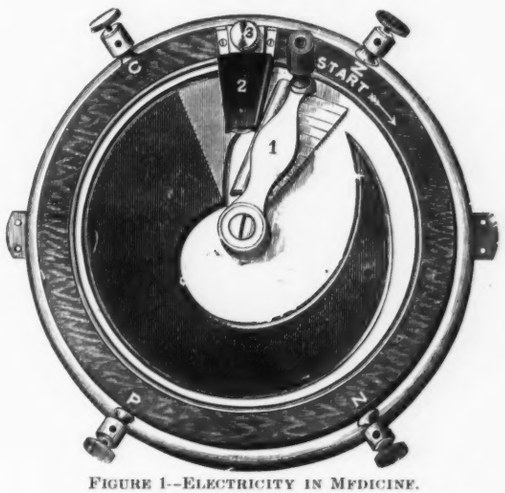


FIGURE 1.—ELECTRICITY IN MEDICINE.
THE MASSEY RHEOSTAT.

The Jewell rheostat is a new instrument made on the same principal and resembling the first-named in form. It consists of a block of slate in which grooves are cut and filled with the resisting substance and so arranged with reference to the moving arm as to make a continuous line equal to the sum of the length of the grooves. It is claimed for it that it possesses all the good qualities of the Massey instrument, having an additional merit of a resisting substance that needs no replenishing.

The Vetter rheostat is constructed on the well-known principle of the variation in resistance which takes place in carbon with a change in pressure. A quantity of granular carbon is placed in a small rubber cylinder, enclosed between two metal plates, to which the two sides of the circuit are connected. The fixed plate is at the bottom of the cylinders and the other is connected to a thumb screw with fine threads, affording a very delicate adjustment. In administering the galvanic current it is a rule always to turn the current on and off very gradually and slowly, thereby avoiding pain and shock. These instruments enable the operator to do this and they possess the great advantage of imposing an equal work on all the cells of the battery. They are

connected in circuit with the terminal wires of the series of cells and save the mass of complicated wires as used with a cell selector. These rheostats are all adapted to use with the portable or stationary batteries.

We shall next consider the method and means used for measuring the dosage or quantity of current used. The instruments used for this purpose are very similar in construction and design to those used for measuring the commercial current, the only material difference being their graduation for thousanths of an ampere instead of an ampere, and for this reason we call them milli-ampere meters or "millimeters." The only portable standard measuring instruments which have been found successful in practice are those of the D'Arsonoal type, in which the actuating force of the index is the current flowing in a coil of wire which moves in a field of one or more permanent magnets, usually of the horse shoe type. In this class of instruments it is asserted that the accuracy may become affected by the weakening of the permanent magnets. A new competitor, the Jewell millimeter, has recently appeared, which claims greater accuracy and less liability to change. The faults above mentioned are avoided by using an improved form of laminated permanent magnets and by so shaping the pole pieces that the magnetic resistance shall be exceedingly small. The instrument has a large travel of index and is so graduated as to afford a horizontal and vertical scale. Milliampere and millivolt meters of the Weston type, so thoroughly familiar to electrical engineers, are also very serviceable and entirely reliable.

Reverting to the Jewell millimeter and referring to the accompanying outline drawing, its action will be understood from the following detailed description: Suppose the current enters at the binding post A. The switch S being opened it passes to N, where it divides, part passing through C, known as the calibrating shunt, to the binding post B, the rest passing through the spiral spring c, the moving coil a, the other spring e, thence to the binding post B.

The resistance of the shunted calibrating coil and instrument coil a then bear such relation to each other that when 10 milliamperes of current pass between the binding posts, the index will be deflected one small division; that is, closing the switch S diminishes the sensitiveness of the instrument ten times, so that a maximum of 1½ amperes may be measured. A pole changer at R renders current measurment in either direction without disconnecting wires from binding posts.

The resistance of the calibrating shunt C and the moving coil a bear such relation to each other that when one milliampere flows from B to A the index will deflect one small scale division. To read above 150 milliamperes the switch S is closed. Part of the current then passes from B through switch S and is shunted to binding post A, the remainder passing via c and coil a to A.

The same instruments described for controlling and measuring the current from stationary and portable batteries may be used on a dynamo current if it does not exceed 110 volts. Among many instruments for controlling dynamo currents for therapeutic work the best are the Gish rheostat, the Vetter current adapter and the McIntosh current controller, the last named being adapted to currents of high voltage. All of these instruments act upon the shunt principle, allowing a main current to pass through a continuous wire, offering a certain resistance and having an additional mechanism for diverting the current at the will of the operator into the patient's circuit.

These devices diminish the voltage as well as the current, an effect of great value in electro-threapeutic work. I have seen the McIntosh instrument working on a 500-volt street car circuit. It gives very uniform and satisfactory results, and is so constructed as to avoid all possibility of danger.

What is said above covers the ground with reference to the source of the current, the instruments for its control and the accurate measurements or "dosage." I have spoken only of the methods and instruments that I consider the best, omitting objectionable methods such as the water rheostat, cell selectors, etc. We shall next consider the means of applying the current to the human body. The means of applying the galvanic current

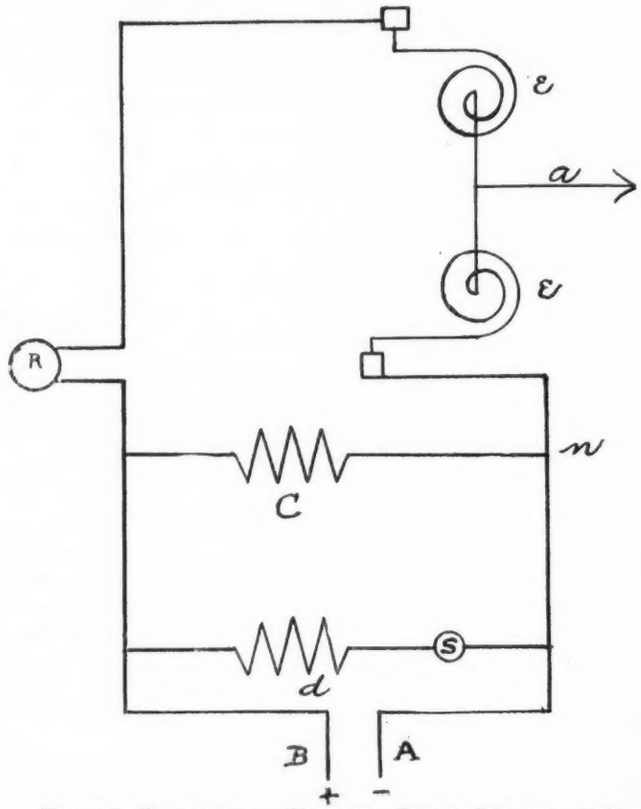


FIGURE 2—ELECTRICITY IN MEDICINE—CIRCUIT OUTLINES OF THE JEWELL MILLIMETER.

to the human body is by electrodes that vary in their construction, size and shape, according to the concentration or diffusion of the current, and the therapeutic effect desired. If applying the current for neuralgia of some special nerve or about the head or face, we use the small hand electrodes, the contact surface being about two inches each way, having small, moist sponges over the neutral or carbon disc. Through these we administer a current of two to ten milliamperes. The stronger current (ten milliameres) would rarely be tolerated without producing great pain or blistering the skin if the active electrode is not moved over the skin or surface. If on the other hand we desire to administer the same current for its deep or penetrating effect, we must choose a large electrode, so as to disperse the current over a large area of the skin surface, in order to lessen the pain. By this method we may administer a dosage of thirty milliameperes without producing pain. A good illustration would be a case if sciatica, commonly called sciatic rheumatism, it being really a neuralgia of the great sciatic nerve. In this case one should apply an electrode (the positive) over the hip or low down on the back, the size of the electrode being not less than 3x5 inches. The foot should be placed on a

larger electrode on the floor, or one of about the same size should be applied to the calf of the leg. After carefully surveying our switches and noting the direction of the current we turn on the current slowly and gradually until we reach the limit of toleration, which will be about thirty milliamperes and this may be continued for ten or fifteen minutes, turning it off in the same manner as it was turned on. The positive electrode is usually placed over the hip in order that the soothing and pain relieving effect of this particular pole may be realized over that sore or tender part of the great nerve, where it issues from the pelvis. With the small electrodes, applied under these conditions the difficulties would be great, beside the limited therapeutic effect would be almost nothing. With the larger electrodes the resistance is decrased, the tension lessened and the arm of the controller will be hardly as far around its cycle as for the ten milliamperes through the small electrodes. For central galvanization, when we desire to reach the great sympathetic nervous system we should use the same electrodes (in size) and place one low on the back of the neck, the other over the stomach or abdomen, or if the spinal cord is to be treated, we place one of the large electrodes at each extremity of the cord.

Now suppose it is desired to concentrate a current to a small area of a mucus surface, inside the human body, for its various therapeutic local or general effects. In this instance we have a great decrease in the resistance between the poles, for the reason that one of them is applied to a moist low resisting surface. We use a small metal electrode, applied to the mucus suface and if we desire a strong current for its electrolytic (or the so-called electro-cautery effect) we shall place a large electrode over the skin surface of some part of the body (preferably the abdomen) which should be at least 8x10 inches in size. The author makes these large electrodes of sheet lead and uses a thick layer of wet absorbent cotton between the lead and skin. In the above instance we should call the larger, the dispersing electrode, and the pointed metal the concentration electrode, the larger also being the indifferent electrode. These small electrodes must be of platinum if we desire to use them as the positive pole. In the apostoli method of treating uterine fibroids by the above method the concentration electrode is a platinum needle and the current strength is often as high as 150 to 200 milliamperes, using a dispersing electrode of moist clay. Such a strong current is rarely if ever used for other purposes in the human body.

I have enumerated and described the ordinary methods of administering the galvanic current and before I proceed to describe other methods I shall touch upon electrolysis, which is the name given to weak galvanic currents applied for the purpose of destroying tissue or altering morbid growths. In the removal of hair, a small delicate needle, the jeweler's brouche, is used. This is carefully introduced into the hair follicle, it being the negative pole, the positive being a sponge electrode held in the patient's hand. Six cells of any good battery is sufficient, the current being from two to three milliamperes. It is not necessary to use a meter, as the blanching of the tissue is sufficient to an experienced operator. If we desire the destruction of a larger growth, such as a tumor, we shall have increased resistance and must use a higher voltage, with about the same current. If a tumor under the skin, we shall use two, three or even four large needles connected to the negative pole. By the same means we destroy all sorts of small tumors, moles, warts, wine marks and other skin blemishes, as well as dissolving strictures and dissolving adhesions, there being special electrodes for these various applications.

The galvanic current is sometimes used for introducing medicines into the body. This process is called cataphoresis, and is an electrical asmosis, used frequently to produce local anaesthesia by means of evolutions of such alkaloids as cocaine and aconitine, also for topical medication in various local lesions, such as tumors, gouty swellings, enlarged glands and various skin diseases. For rheumatism and gouty swellings solutions of the various preparations of lithium are employed. This medicine is driven in, as it were, by means of the current, and acts directly by dissolving any concretions that may exist in the affected part, as a result of the disease. Medicines used in this way are always used in solution and on the positive pole, for reasons that are obvious. The gavanic current alone is frequently used for its dissolving effect upon adhesions around various organs inside the body. The strength of current for cataphoresis is from five to ten milliamperes. By this means chloroform may be used for dissolving gall stones inside the gall bladder.

A similar method of applying medicines or chemicals by means of the galvanic current for their local effect is by means of metal electrodes, such as zinc and copper. This is a local electrolysis, a decomposition by electricity. Both poles are sometimes used close together for destroying malignant tumors. A platinum electrode wrapped with absorbent cotton, moistened with iodine or carbolic acid, is a means of application to mucus surfaces for its local caustic or alterative effect. Some varieties of cancer are effectually destroyed by zinc-amalgam cataphoresis, a blunt amalgamed zinc electrode being passed into the growth, after anaesthesia has been produced by cocaine, and a current of 150 milliamperes passed.

Water electrodes are sometimes used to facilitate the local application of plain or medicated solutions. This electrode consists of a hard rubber nozzle, inside of which is a platinum wire. The connecting end is bifurcated, one connection leading to the water supply or medicated fluid, the other to the battery. As the water passes over the platinum wire it becomes the electrode and closes the circuit by contact with the body. This is a valuable means of treating skin diseases, ulcers and many other superficial ailments.

We use special electrodes for applying the galvanic current to the eye, ear, nose and throat; also for treating the various diseases of the mucus surfaces, and internal organs of the body. These various instruments would require too much time and space for special description I shall next consider the faradic, static and other high tension currents, and the various methods of generating and applying to the human body.

Personal

Mr. A. C. Balch, formerly of the Union Power Company of Portland, was in San Francisco recently.

Mr. Charles Stein, the tie-plate expert of the Q. & C. Company of Chicago, will shortly return to San Francisco with headquarters at the Palace hotel.

Mr. Edward B. Ellicutt, superintendent of construction for the Western Electric Company of Chicago, is on the Coast on a trip combining business and recreation.

Mr. J. A. Cranston, assistant to Mr. S. Z. Mitchell, manager of the Pacific district of the Northwest General Electric Company has returned to Portland after a brief business visit.

Mr. I. Sternfeld of the City of Mexico and who is Mexican agent of the Westinghouse Electric and Manufacturing Company, was in San Francisco recently closing the orders for several large transmission plants.

Mr. H. T. Llyod, the genial representative of the Stirling Electric Supply Company at Topia, State of Durango, Mexico, is in San Francisco, perfecting arrangements for prosecuting the Mexican business of his company with renewed vigor.

Mr. E. W. Little, whose long and intimate association in the management of the Interior Conduit and Insulation Company has won for him a universal popularity, has resigned the vice presidency and general managership of the company and has been succeded by Mr. Allan C. Bakewell.

Mr. W. S. Heger, manager of the Pacific Coast office of the Westinghouse Electric and Manufacturing Company has returned to San Francisco from Pittsburg with plans for a campaign so fully matured that the measure of their aggressiveness is only exceeded by his personal popularity among those with whom he has business dealings.

Mr. L. H. Griffith, formerly of the Griffith Bank at Seattle, Wash., is at the Grand hotel, San Francisco. At present Mr. Griffith is residing in Guatamala, where he holds important government concessions for building electric street car lines in Guatamala City and Antigua and connecting the two places which are seventy-two miles apart, by electric road.

Mr. John Richards has retired from journalism and with his retirement the publication of Industry has ceased. This announcement has been received with deep regret by the thousands of admirers of his writings, whose gratitude for the frankness, fairness and fullness of Mr. Richards' engineering writings form an ever living and world-wide testimonial of appreciation, to earn which any lifetime is well spent.

John F. Outwater, representing Mr. Hugo Reisinger and the high-grade Nuernberg "Electra" carbons, and who is combining business and recreation in a tour of the Coast, is at present at the Palace Hotel. Since its inception almost, Mr. Outwater has until very recently been purchasing agent of the Brooklyn Edison Company, and the ripe experience there gathered makes him one of the best posted men in the country on the efficiency of electrical supplies.

Professor A. Vander Naillen, the well-known president of the school of engineering in this city, is on the eve of journeying to Paris, France, where he will study the latest progress made in the engineering sciences, and especially in that of electricity. The professor departs loaded down with credentials from the Governor of the State and many different consules here addressed to the various ministers of state in Paris, which will open wide to him the doors of the higher institutions of scientific learning. Mr. Vander Naillen will reap a rich harvest of scientific information which he will bring back to this Coast for the benefit of the public in general and especially for the advancement of his own students, as he is determined that the Vander Naillen school of Engineering shall rank among the best.

ELECTRIC ELEVATOR REGULATION.

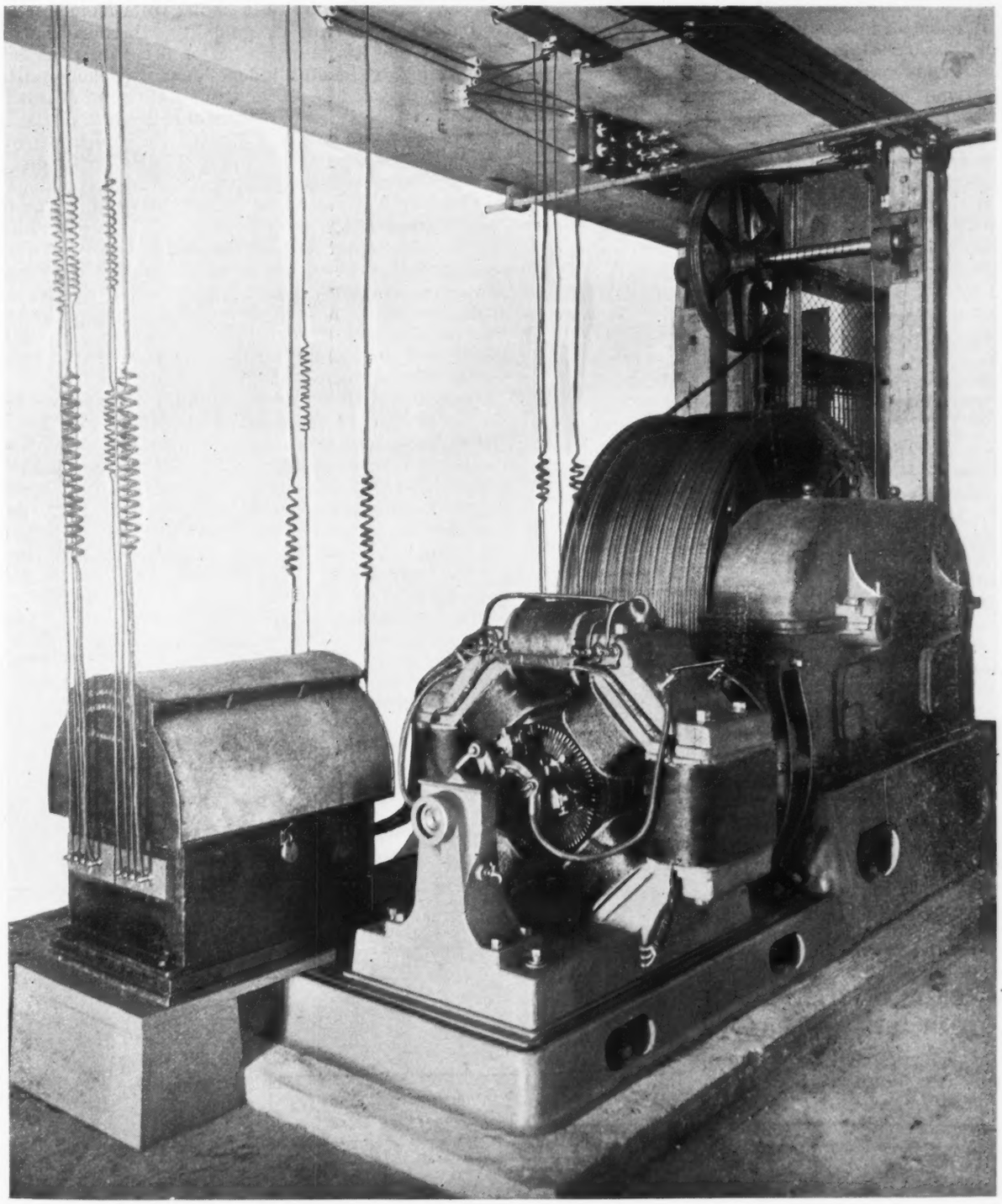
An interesting example of the effiecient application of electric power to the operation of high speed passenger elevators is found in the installation placed by the Electric Engineering Company in the famous Cliff House in this city. The elevator has a direct lift of an even 100 feet and the general character of the equipment is shown in the accompanying illustration from a photograph of the plant as erected. Briefly described, the plant consists of a 25-horsepower Electrical Engineering Company's motor of special type, geared to a sheave drum through worm gearing and operated from the 500-volt circut of the Sutro railroad.

To describe the apparatus in detail is inadvisable at the present time, owing to the fact that patents on its vital features are pending, but an idea of its method of control will be gathered from the statement that the controller proper and which is inclosed in the locked iron casing shown in the illustration, consists of a solenoid, the core of which effects four different combinations of field windings so as to give four distinct rates of speed. This solenoid is actuated by circuits which are manipulated by the operator in the elevator car through an ordinary form of controller lever that forms the various switching combinatios desired. The controlling mechanism is therefore purely electrical and its distinctive feature, which at the same time forms a most valuable characteristic because of the entire elimination of the use of resistance of any form, consists in the commutation of field coils so that the entire energy rushing into the motor upon starting becomes available for torque. It will be noted that the motor itself presents the peculiarity of having windings across the yokes of the pole pieces in addition to the regular field windings. There are, therefore, eight field coils on the machine, and these are of equal ampere-turns and the function of the controller is to commutate these coils.

How this is done will be made clear in a general way from a brief description of the method of operation. The motor is compound wound and when at rest the eight field coils are all in series, and act as a resistance, but the energy expended in them is obviously utilized in magnetizing the fields. The first action of the controller solenoid is of course to fix the armature polarity and then to energize the fields. These functions are performed in the ordinary manner and before the current is thrown on the armature the equipment is coupled as a simple series motor. The fields are highly over-saturated, thus giving a tremedous torque, which at once carries the elevator with an acceleration only equaled by that of the hydraulic form. The various successive stages of the controller commutate the field coils so as to weaken the fields until, when at the final speed, it is run as a simple shunt motor. A bank of 16 lamps in series is placed in parallel with the field coils to take up the discharge and the motor is, as shown, of the two-brush multipolar type. The armature shaft is coupled direct to the worm shaft through a flexible insulated coupling and also carries a twenty-inch brake pulley against which presses two brake shoes, one of which is shown in the illustration. These brake shoes are automatically controlled in starting and stopping by a solenoid carrying a compound winding, the series winding constituting a portion of the main circuit to assist the shunt winding to instantaneous action.

The winding drum has a diameter of sixty inches and carries two sets of five-eghths-inch steel ropes, so con-

rected to the drum that as one set unwinds the other set reels up, and visa versa. The first set consists of four ropes that are attached to the top of the car after passing over a sheave at the top of the elevator well, while similarly the second set, containing two ropes, is fixed to the top of the counterweght, the only distinction being that the counterweight ropes are guided into the elevator shafe by running under an idler sheave on a spirally grooved shaft. All bearings except those for the drum are of the self-oilig type and the gears are of phosphor-bronze, twenty-eight inches in diameter. The worm shaft carries two hardened steel worms, one right and the other left-handed, thus avoiding all end thrust by exerting a balanced pull, the effort of the second gear being transmitted to the shaft carrying the drum by means of cog gearing which, together with the worm gearing, runs in castor oil.



ELECTRIC ELEVATOR REGULATION.

The car travels four inches to each revolution of the armature, and in addition to all mechanical safeties the equipment is provided with electrical safeties which instantly open the main circuit and lock the entire system in case of trouble.

Owing to the utilization of the energy which in all other types of elevators is wasted through the use of starting resistances, a material economy in current consumption is claimed to be effected and readings taken show that in starting the outfit the initial energy momentarily dashes the needle to approximately 19 to 22 kilowatts, instantly falling to 10 or 11 kilowatts and in less than four seconds dropping to as low as from 5 to 7½ kilowatts according to the position of the controller.

In marked contrast to these readings are those showing the energy consumed by either of the two electric elevators of Eastern manufacture istalled in the Safe Deposit building in which the momentary dash of the needle at the start shows from readings varying from 28 to 40 kilowatts and a minimum consumption of 17 kilowatts. This was after the machines had been running sufficiently long to assure smooth operation as is attested by the fact that at the outset each of the Eastern equipments in the Safe Deposit building consumed over 400 amperes at 110 volts, or about 45 kilowatts in starting.

THE PORTLAND TRASMISSION PLANT.

Since the publication of the article in the December issue of this paper concerning the plant of the Portland General Electric Company considerable progress has been made towards the completion of this interesting installation, particularly in the fact that the rotary transformers are now in operation and are giving excellent satisfaction. With the advent of electric power derived from the falls of the Willamette at Oregon City several steam plants have been closed down, prominent among which is that of the Union Power Company in North Portland. This latter formed an installation that was noteworthy in several respects and which commended considerable attention four years ago, first on account of its being the first railway power plant feeding in to two separate railway systems on a three-wire system of distribution, and second, because of the ingenious manner by which refuse saw dust was conveyed to the plant and automatically fed to a battery of boilers having a capacity of about 1,500 horsepower.

Station A of the Portland General Electric Company is loaded to its utmost capacity and from station B is being operated two three-phase 750 kilowatt machines, the first of which is carrying more than its rated load of incandescent lighting on the four-wire system of distribution heretofore described in these columns and in some instances the load has been so heavy that the company has been compelled to help out the generator with an isolated steam plant in the Marquam and Dekum buildings. The second three-phase machine furnishes power to a rotary transformer from which is operated the half of the Oregon City railroad running between East Portland and Milwaukee, the Barnes Heights and Corneel Mountain road, the Vancouver line, all the city and suburban district lying south of Alder street in East Portland, the new First street line running from Jefferson to Burnside streets in Portland and the commercial power circuit, averaging about 150 amperes. Despite the heavy load carried the service given is better than that obtained from the steam plant formerly used. The third three-phase generator is about ready for use, the delay in putting it in operation having been due to not having the line construction finished between Oregon City and Portland.

As stated, the Portland half of the Oregon City line is operated from the rotary transformer, while the remaining half is fed from one of the 250-killowatt 500-volt exciters in station B at the falls. The entire railway system is now continuous; that is, the circuit is not broken at Milwaukee, the middle point, as heretofere, but instead current is fed to it at 550 volts from Portland and at 600 volts from Oregon City, which gives at the center of the line a much better pressure than could be obtained by feeding independently at each end. The matter of regulation on the Oregon City end of this line has always been a very serious one, because of the fact that no means have been devised for improving upon manual regulation of the water wheels, but under the new arrangement much better results are attained as the feeding point of either end of supply shifts according to the position of the cars and the feeder losses, which tends to act as a regulator for the water wheels in station B. The circuit breakers on the rotary transformer at Portland have been thrown out repeatedly with apparently no effect on the exciters pulling the Oregon City end of the road except an increase in the speed, but this condition does not prevent the circuit breakers being thrown simultaneously.

A 6,000-volt three-phase line has been erected from the substation at Portland to the Portland Flouring Mills, some three miles further down the river, where the potential will be reduced by three special 33-cycle transformers to 350 volts for operating a 75 horespower induction motor that is to drive the elevator at the flouring mills. This installation is preliminiary to operating the entire mill by electric power, and the work of changing the equipment of the Portland Cable Railway Company from cable to electric with the exception of that portion ascending Portland Heights at a very heavy grade, is in progress. The steam plant at the cable power house is to be abandoned and while the electric division of the road will be operated from one of the rotary transformers the cable machinery will be driven by induction motors after the plan installed in the Portland Flouring Mills.

The Trade.

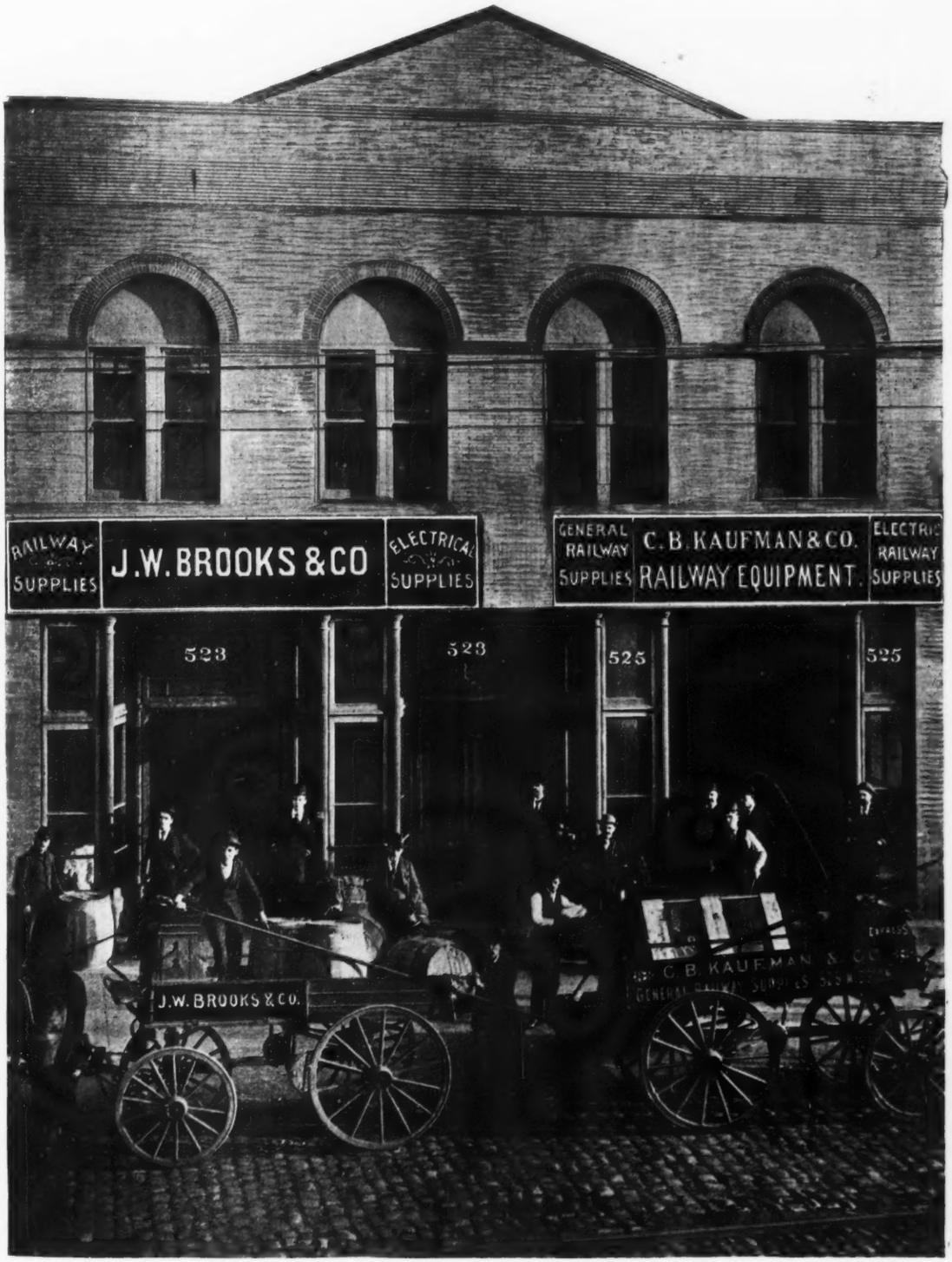
In Responding to advertisements in this publication, please mention "The Journal of Electricity."

THE NEW FORT WAYNE OFFICES.

As announced recently in the advertising columns, the San Francisco office of the Fort Wayne Electric Corporation has now been established at 18 Second street and the quarters are without doubt the most elegant to be found on the Pacific Coast. Mr. Charles R. Llyod, so well known to the electrical fraternity of the far west, is in charge of the office, which is also occupied by Mr. John R. Cole, whose labors, coupled with the intrinsic merits of the product itself, has made Grim shaw wire the most extensively used insulation on the Pacific Coast. The engineering department of the office is in charge of Mr. Frederick G. Cartwright, and the parties named form a very popular trio whose energies will certainly win a great portion of the desirable business that is to be found on the Coast. The Sterling Electric Supply Company, which is under the immediate direction of Mr. Cole, occupies the quarters with the Fort Wayne corporation conjointly and the office is thus prepared to handle every electrical proposition of whatever nature that may arise.

A RAILWAY SUPPLY CENTER.

It is well known that until the past year one of the great electrical corporations held an undisputed monopoly of the electric railway business of California if not of the Pacific Coast, and that this situation has now been most effectually broken is evident upon looking over the advertising pages of the Journal, from which it will be seen that the business of selling railway supplies is now very thoroughly exploited. The accompanying illustration shows a railway supply center in San Francisco, and although it is but one center of several and although the concerns there located are the youngest in the field, the business transacated in furnishing supplies for electric and steam railways, in addition to the furnishing of electric lighting supplies of every description, has reached a proportion that is most gratifying.



The Day Press.

POPULAR REFLECTIONS OF THE CONDITIONS AND PROSPECTS OF ELECTRICAL ENGINEERING ON THF PACIFIC COAST.

Business with the electrical supply and machinery people is veiry fair, and the outlook for the coming year is better than it was a year ago. Most electrical people are doing a very good business, although some of them say things are dull, but as a rule they are, if not just at present rushed with business, at least full of hope.—Los Angeles (Cal.) Journal.

Owners of land along the line of the California railway, out Laundry Farm way, can well afford to give a bonus to have that line converted from a steam to an electric road. When it is seen how the Haywards line has increased real estate values along the county road it may be judged how it would pay to have this little steam road, running into the most delightful of suburbs, changed into an electric, with frequent trips at low fares.—Alameda (Cal.) Argus.

The destruction of the dynamos of the electric lighting plant at Haywards the other day in the midst of an electric storm warns proprietors of electrical machinery in California that lightning arresters should be put into all their works. Because lightning is very infrequent in this State is no reason for neglecting a precaution, the failure to provide which may result in such great damage and so much inconvenience to a community.—Sacramento (Cal.) Record-Union.

The electrical plants of the Standard Consolidated Mining Company have proved a success and have enabled that company to work its mill and mine more economically than under the old system, and the time will surely come when Bridgeport will be the center of electrical mining plants for the systematic and economical working of the Bodie and other mines in this vicinity. We have an abundance of water power and it is destined for such a purpose.—Bridgeport (Cal.) Chronicle-Union.

The steps now being taken by the City Trustees to increase the electric lighting plant are fraught with gravest consequences to the taxpayers of this city. No one disputes the right of municipality to light its own streets and public buildings, but when it engages to supply private consumers it is going beyond the rightful exercise of the legitimate functions of municipal government; it is entering into an undertaking that at the most is purely experimental. * * * Alameda has had its experience with electric lighting plants and it has been a sad one to the taxpayers.—Alameda (Cal.) Telegram.

Counties are being asked to grant the right to use the public roads for electric railways, and perhaps for the day it might be better to grant the right to run on the roads, but shall we never look to the future in such matters? In how far may the counties undertake the construction of these roads? A corporation uses its credit to build a road, and a county having credit can use it. The corporation gets its pay back by tolls, and why may not the county do so until the debt shall be paid off. If we believe at all in public ownership of transportation lines let us show our belief by taking hold of this new phase while we may do so without any question of wronging any one, or while it may be done without creating so vast a public debt.—Colusa (Cal.) Sun.

All signs of the times at present point to great mining and business activity in this vicinty in the near future. With the advent of that gigantic enterprise, the Bend Electric Power Company, now an assured fact, comes the reliable information that numbers of good mining properties that have lain practically dormant for years are to be opened up and worked on a large scale. We are in possession of authentic information that one mining company, which has in the past been doing development work on its extensive properties only on a small scale, has signified its intention of taking 100 horsepower from the Bend Company as soon as the same can be furnished, and also will erect a 100-stamp mill, and possibly a larger one, with all the attendant buildings and shops. The company has ample capital and is only waiting the introduction of cheap power to proceed with the work on the most extensive scale. And what is true of this company is also the case with numerous other companies and individuals.—Coulterville (Cal.) Miner.

There is a lively interest just now evinced all over the State in utilizing the vast water power of the mountain streams. It is well. The great cost of power to run mills and manufactories is one of the chief reasons why so little local manufacturing has been carried on in California. Coal has been too dear and the best water power hidden away in inaccessible mountain gulches. The new idea of putting dynamos in the hidden places and sending out the power on electric wires over mountains and gulches miles away to railway stations and steamboat and tidewater towns is practical and full of good promise. It will be but a little while till hundreds of places will be supplied with electric power as cheaply as anywhere in the East. When, through the pressure of hard times the labor question, that other stumbling block to successful manufacturing on the Coast, is so far settled as to stamp a badge of honor on every working man, every serious obstacle in Califonria's strides in industrial progress will have been removed. In view of the situation, our own locality has every cause to rejoice over the power that Cache creek can furnish for all time—enough to make the wheels hum in a row of factories thirty miles long. Wake up!—Woodland (Cal.) Mail.

It would appear from explanations made by electricians that under certain conditions even a heavily insulated wire is deadly. This is an important fact for the public to know, as heretofore an insulated wire has generally been regarded as harmless. It sems that an electric light wire should be treated with as much caution as a gun, which timid people regard as dangerous "without lock, stock or barrel."—San Jose (Cal.) News.

It is really time to draw the line on the irresponsible votaries of science. They are carrying things altogether too far. It is bad enough for Professor Roentgen to enable the intrusive snapshot fiend to exhibit to an unfeeling world photographs of the dorsal vertebrae of gentlemen who might be total strangers to him and radically averse to such extreme publicity, but when Mr. Edison undertakes to photograph the interior of the skull and show what, if anything, the victim has inside, and Professor Salvioni enables the human eye to see anything that the Roentgen rays can penetrate, the case demands the interference of the police. Heretofore a person of discretion has been able to congratulate himself on not wearing his heart on his sleeve; but that precaution will be useless when anybody can inspect the workings of the heart in its normal position, and even see what the owner has had for dinner. If everything is to be transparent to the prying eye of science what is the use of clothes, and why not return to the original Edenic condition? Will the front orchestra chairs at the ballet be provided with notices reading: "Drop a dollar in the slot and take out a Salvioni opera glass?" If Edison's malign invention for photographing the interior of the skull prove successful it will work havoc among reputations that have been a precious possession to the community. A noble presence, an air of dignity and conscious power have made a leading citizen of many a man of whom it may be said, in the language of Mr. Bierce, that he "can't write and he can't talk, but they do say that he is a devil to think." Now suppose some ribald scientist should come along with an Edison Paul Pry camera and take a photograph showing a vacuum in that honored citizen's cranium, where the reverent

multitude had confided in the existence of a bulging mass of gray matter. The foundations of society would be shaken. The masses have always been awed by the thought of the mysterious powers that lay behind the impenetrable brows of their great men. How is their reverence to be maintained when the brain of a statesman or divine becomes as visible as the wart on his nose? No; science has clearly overreached itself this time. Most of us want to have a few illusions remaining, and those who prefer to have absolutely nothing left to the imagination can read Zola and Thomas Hardy.—San Francisco Examiner.

Municipal ownership is very much like a man with an income of $100 per month living upon $150. Somebody pays for the excess of expenses over receipts. If it were a clerk in commercial circles his employer would pay for it in a surreptitious manner. In municipal circles it is the taxpayer who submits to the extra burden. Compiled from reports filed with your city officers, I find that, exclusive of interest, the cost of lighting your city for six years and five months has aggregated the sum of $155,223.74, an average of $2,016.27 per month, of $22.90 per lamp per month, and of 19½ cents per lamp per hour. A very liberal estimate of the value of the permanent part of your plant is $30,000, which being deducted, will leave a net expense of $125,223.74, which gives a monthly lighting expense of $1,626.20, or in round numbers an expense of 15 cents per lamp hour. This is without the consideration of interest which has been paid upon the original purchase price. It contrasts very forcibly with the rate charged in Oakland for municipal lighting—of 6.43 cents per lamp hour—the first basis of hourly expense as figured being three times that of Oakland and the second nearly twice. * * * Assuming that all construction work should stop; that your station is in such a condition that no repairs will be required for the next six years; that no towers are to be taken down; no new lamps erected; no poles to be painted; no boilers or steam pipes to be overhauled; no engines to be repaired; no armatures to be rewound; no incandecsent lamps to be renewed; no lamps to be furnished with new parts; no transformers to rewind, and that the expense of maintenance would be only that figured out by your interested employes. Assuming all this, the average cost of the maintenance of your municipal lighting plant would still be, according to the figures which I have submitted to you, more than 75 per cent in excess of the charges made in any other city in the United States for the lighting of the streets.—Abstract of an open letter from John A. Britton to the Board of Trustees of the City of Alameda, Cal.

Reports of the Month.

COMMUNICATION.

FORT JONES, Cal.—Manuel Pereira is to erect a private telephone line between his new electric light station and this place.

SONORA, Cal.—The Sonora Electric Light Company is installing a telephone system throughout this vicinity to afford communication between the different stations and with San Francisco.

SAN FRANCISCO, Cal.—The Sunset Telephone and Telegraph Company has issued orders that certain operators of its country lines must learn telegraphy in order that they may be competent to use the telegraph as an adjunct to long distance telephoning in the transmission of service messages.

INCORPORATION

SALT LAKE CITY, Utah.—The Electric Gold Mining and Milling Company; capital, $3,000,000; all subscribed. Officers: W. L. Nichol, president; H. D. Bastain, vice president; R. W. Nichol, treasurer; S. J. Weigel, secretary.

SPOKANE, Wash.—The Arlington Heights Company; capital stock, $100,000. Incorporators, J. J. Smith of New York, D. S. Walton of East Orange, J. R. Simmons et al. Object, to furnish water, light and heat to the occupants of Arlington Heights and to buy and sell land.

SAN FRANCISCO, Cal.—The Continental Motor and Traction Company; capital stock, $1,000,000, of which $35,000 has been subscribed. Directors: Philip La Montague, W. R. Smedburg, A. J. Bowie, G. I. Ives and W. B. Harper. Gold Mining Exchange. Officers: Walter Turnbull, president; John Daggett, vice president; D. E. Miles, treasurer; J. F. Crossett, secretary. Offices, Mills building.

OAKLAND, Cal.—The Oakland & Livermore Valley Railroad Company; capital stock, $3,000,000. Directors: E. P. Vandercook, George D. Metcalf, A. D. Wilson, H. H. Pitcher and Rod. W. Church. The new company has absorbed the franchise held by E. P. Vandercook for an electric road from East Oakland to Livermore via Dublin and thenew line will have its terminus at the Corral Hollow coal mines.

LITIGATION.

ALAMEDA, Cal.—John T. Fleming has applied to the Superior Court for an injunction restraining the Board of Municipal Trustees from carrying on certain contracts involving the expenditure of a large sum of money to enlarge the municipal electric light plant for the chief purpose of engaging in the business of furnishing incandscent lights to private consumers.

SAN LEANDRO, Cal.—A. C. Hammond Jr. has applied to the Superior Court for a restraining order to prevent the City Trustees of San Leandro selling a $10,000 bond issue intended to purchase an electric light plant. Hammond claims that the election was illegal because the Board of Trustees did not have plans and estimates of the cost of the proposed plant before the election was held.

LOS ANGELES, Cal.—Justice Young, acting upon the verdict of a jury, has rendered the decision that the Los Angeles Athletic Club is not liable for gas which the Los Angeles Lighting Company claims was consumed by the athletic club during five months of 1893 and which did not show up on the meter of the company placed in the club rooms to register the amount of gas consumed.—Thomas F. Tedford has sued the Los Angeles Electric Company for $25,000 damages for injuries alleged to have been sustained while in the employ of the company through its neglect. Plaintiff alleges that he was employed in digging post holes and, acting under orders of a line foreman, he went up an electric light pole and coming in contact with a live wire received a shock which caused him to fall to the ground, fracturing his skull and breaking his leg.

TRANSMISSION.

BODIE, Cal.—The Index is trying hard to induce capitalists to erect an electric power plant for the mines in this vicinity.

OROVILLE, Cal.—The Oroville Gas and Power Company has made arrangements with the Palermo Land and Water Company for more water for running its electric plant.

BERKELEY, Cal.—Power for operating machinery in various colleges of the University of California is now supplied from a 20-kilowatt, 110-volt Edison dynamo in the mechanical engineering department.

ALAMOS, Mexico.—Two 15-horsepower electric motors manufactured by the Electrical Engineering Company of San Francisco are being installed to operate two Richards triple-throw pumps in the Alamos mine.

RIVERSIDE, Cal.—The butts of the poles used on the transmission line for this city and Colton and which line is to be

thirty-nine miles in length together with the fross arms, are being coated with P. &. B. paint.

SACRAMENTO, Cal.—Mayor Hubbard has approved an ordinance granting the Central California Electric Company privileges for supplying electric power transmitted from the foothills of Placer county.—A 25-horsepower, 500-volt Westinghouse motor has been placed in the Capital Box Factory.

STOCKTON, Cal.—H. K. Southwick is believed to be investigating the feasibility of transmitting power from the Salt Spring Valley reservoir to this city. The plan contemplates the development of electric power from the water to be furnished the Plymouth mine, but the reports have not yet assumed tangible shape.

NEVADA CITY, Cal.—The power transmission plant of the Nevada County Electric Power Company, using Stanley apparatus throughout and which was fully described in the November issue of the Journal of Electricity, was put in regular operation on February 6th and is delivering light and power to perfect satisfaction.

SAN FRANCISCO, Cal.—Two 25-horsepower multipolar motors of the Electrical Engineering Company's slow-speed type are being installed in the Bryant street power house to operate blowers.—The Electrical Engineering Company is installing a high-speed passenger elevator in the Saint Anns building and a direct connected freight elevator in the Lilienthal building.

SONORA, Cal.—The Sonora Electric Light Company will be delivering 100 horsepower to the Rawhide mine by means of its new electric plant early in March. The new pole line of the company carries three cross arms for power, lighting and telephone purposes and the lighting circuits in Sonora will branch off at Springfield and terminate at Shaw's Flat with another branch line extending to the marble works.

FRESNO, Cal.—The One Hundred Thousand Club has appointed a committee to perfect plans for an electric carnival to celebrate the completion of the transmission plant of the San Joaquin Electric Company during the coming month. The pole line for the thirty-five miles transmission for the San Joaquin Electric Company has been completed and the crew is erecting poles for the city distribution circuit.

SALT LAKE CITY, Utah.—Satisfactory progress is being made in the direction of the Big Cottonwood power transmission plant. The dam, pipe line, station building, water wheel and dynamo foundations, pole line and transmission circuits are all completed and it is expected that the plant will be in operation by the 1st of April. The company has filed a deed of trust to the Old Colony Trust Company of Boston to secure an issue of $500,000 first mortgage bonds. The instrument conveys the entire electric plant, together with reservoir, pipe line and power station, in addition to several pieces of land. George W. Donellan is president and George M. Cannon is secretary of the Big Cottonwood Company.

SANTA CRUZ, Cal.—Messrs, Swanton & Robinson have given the Westinghouse Electric and Manufacturing Company a contract for the machinery for the first installation of the Big Creek Electric Power Company. The order is for a 150-kilowatt, 1,000-volt, two-phase generator at 7,200 alternations per minute which will supply a bank of self-cooling special Westinghouse transformers that will deliver three-phase current at 11,000 volts to the line. The length of transmission is eighteen and three-quarters miles, and at the substation special step-down transformers will reduce the line current to 2,000 volts, back again to two-phase current for local distribution. Oil transformers having a capacity of 75 kilowatts each will be used as will triple petticoat porcelain insulators of the Fred M. Locke type. The pole line will carry two circuits for power and lighting respectively, which will be carried on seven-foot and five-foot cross arms. In addition the poles will carry a telephone circuit supported on Locke's patent transposition insulator. A Pelton water wheel of 500 horsepower to operate under a head of 1,025 feet is to be installed and the plant is to be completed by May 15th. An order for an additional 150-kilowatt outfit is to be given for six months later and will probably be followed by a third order for 300 kilowatts more. The company has received all deeds to the lands on Big Creek for its operation, and a fifty-year franchise for the erection of poles, lines, etc., has been received from the County Supervisors.

TRANSPORTATION.

STOCKTON, Cal.—The Stockton Electric Railroad Company is contemplatiing the extension of its system into Fairoaks tract.

PASADENA, Cal.—A spur of the Pasadena electric road is to be built to the Crown City Cycle Club grounds on Lincoln avenue.

SANTA BARBARA, Cal.—Work is being prosecuted on the new power house at Summerland for the new electric railway system.

HONOLULU, H. I.—F. S. Dodge, constituting a committee appointed by the last Legislature to investigate the railway systems in the United States reports, that electric railways are feasible and advisable in Honolulu.

SAN BERNARDINO, Cal.—It is stated that the work of equiping the Southern California Railway line with electricity will commence early in April and that the contract for furnishing power has been given the San Bernardino Electric Light Company.

ALAMEDA, Cal.—The Board of City Trustees has awarded a contract to John Martin, representing the Stanley Electric Manufacturing Company of Pittsfield, Mass., for a 200-kilowatt, two-phase Stanley generator, complete with station equipment.

REDLANDS, Cal.—The projected electric railway to Canon Crest Park has not been abandoned as it is believed that the necessary capital will soon be available. The road if built will be operated from the plant of the Redlands Light and Power Company. The franchise expires in November.

CITY OF MEXICO, Mex.—It is currently reported that an electric railway is to be constructed to the Kotol, San Rafael, and adjacent mines for the purpose of shipping their enormous output, and also that the present system of horse car lines in this city will soon be displaced by electric railways.

RIVERSIDE, Cal.—It is understood that within a few days a franchise will be applied for for an electric road to run from the Santa Fe depot down Seventh street to Main street, thence south on Main to Fourteenth street. It is probable that the street car line on Magnolia avenue will soon be operated by electricity.

SANTA ANA, Cal.—It is reported that I. W. Hellman of San Francisco has become interested in the Santa Ana, Orange & Tustin Street Railway Company, and that the road will be changed to an electric line. The Board of Trustees has, however, declared the franchise forfeited and ordered the removal of the tracks within thirty days.

SAN FRANCISCO, Cal.—The Union Iron Works has received a contract to construct three new 1,200-horsepower engines to be placed in the Bryant street power house.—The Presidio & Ferries Railroad Company contemplates changing the steam motor line running from Baker and Greenwich streets to the beach at Harborview into an electric line as soon as the street improvements now under way are completed.

LOS ANGELES, Cal.—Application is to be made for a franchise for a $75,000 electric road to cross the Los Angeles river, Santa Fe and terminal tracks, to Boyle Heights, traversing Fourth street to Fresno avenue, terminating at Evergreen cem-

etery. The electric road from Altadena to Santa Monica will be in operation early in March. W. J. Broderick, a heavy stockholder in the Main street car line is authority for the statement that new track will be laid and electric cars be running over the main and Fifth street lines early this summer.

OAKLAND, Cal.—An ordinance has been adopted restricting the speed of street cars to eight miles an hour in the district bounded by Sixteenth, Franklin, Washington and the southerly charter line of the city and imposing a penalty of $100 for its violation.—The Oakland, San Leandro & Haywards system is building an extension of its line on Twenty-third avenue northward from Twenty-second street to the Hammond tract, a distance of half a mile.—The California Railroad Company, operating the Standard steam road from Fruitvale to Laundry Farm, has offered to equip the system with electricity if the property owners along the road will contribute $20,000, the entire change costing over $70,000.

SAN JOSE.—L. M. Hale has been granted a forty-year franchise by the Board of Supervisors for an electric railway from the western limits of the city on San Carlos street over the Saratoga road through Saratoga to Congress Springs. According to the provisions of the franchise, the road will run along the south side of the Stevens creek road and the easterly side of Saratoga avenue, and freight cars will not be permitted to run further east than the track of the South Pacific Coast Railroad. It will be standard gauge throughout, and the work of construction must commence within six months after the franchise has been awarded. All freight cars must be run at night. The road must be completed and cars running within one year from the date of the franchise. The fare is limited to thirty-five cents for the entire distance and to ten cents for three miles, and six trips each way must be made every day.—It is reported that John Center of San Francisco, who has secured possession of the Alum Rock Railway, will equip the line with electricity. The following have been elected directors of the Alum Rock Railway: J. J. Scrivener, president; Jacob Miller, J. T. Grant, Samuel Center and James N. Spence (secretary).

ILLUMINATION.

PHOENIX, A. T.—Gus Hirschfeld is to install an isolated incandescent plant.

SAN JACINTO, Cal.—A Mr. Reid of Pomona has applied for an electric franchise.

CATHLAMET, Wash.—An incandescent light plant is to be placed in Trescott's big packing house at Goble.

TUCSON, A. T.—The Tucson Gas Company has been purchased by the Electric Light and Power Company.

CALISTOGA, Cal.—A movement is on foot to put in an electric light in this city to have a capacity of 500 lights.

REDONDO, Cal.—G. J. Lindsay & Co. are reported to be contemplating the erection of an electric lighting plant here.

OROVILLE, Cal.—The Aurora mine at Magalia is to install an electric light plant for lighting the underground working.

BENICIA, Cal.—Foundations are being built preparatory to the placing of new engines in the electric light plant.

AUBURN, Cal.—A 1,000-light alternator is to be placed by the Ball Electric Company to replace the 300-light machine now used.

COLTON, Cal.—The City Council has awarded the contract for erecting the municipal lighting plant to Wilcox & Rose for $5,847.

FRESNO, Cal.—The San Joaquin Electric Company will probably light the court house and jail with about 25 incandescent lamps.

HOLLISTER, Cal.—A new Corliss engine of double the capacity of the present engine is to be placed in the electric light plant.

SANTA MONICA, Cal.—The proprietor of the North Beach Bath House contemplates installing an isolated electric lighting plant.

SAN DIEGO, Cal.—F. S. Hartwell has secured the contract for placing the 500-light incandescent plant in the Marston building.

SANTA BARBARA, Cal.—The new holder of the Santa Barbara Gas Company, which has a capacity of 30,500 feet, is about ready for use.

FERNDALE, Cal.—F. C. Nelson & Co. are installing a 45-kilowatt single-phase Westinghouse alternator for commercial lighting purposes.

REDWOOD CITY, Cal.—The circuits of the Redwood City Electric Light Company are to be extended to Menlo Park, Palo Alto and San Carlos.

SANTA ANA, Cal.—It is proposed to call a special election to vote about $1,500 bonds for the purpose of increasing the municipal lighting plant.

SAN PEDRO, Cal.—The pole line between this place and Long Branch has been completed and San Pedro will have electric lights by March 20th.

OAKLAND, Cal.—The Judson Manufacturing Company has placed twenty-four Upton arc lamps on the incandescent circuits of its isolated plant.

BANDON, Or.—The Board of Trustees is considering a plan of installing an incandescent dynamo in the woolen mill and to light the town thereby.

BANDON, B. C.—Samuel Lovatt is inquiring as to the cost of electric lighting plants with a view of installing a dynamo in his sawmill for lighting the town.

REDDING, Cal.—The mill and chlorination works at Hart are to be lighted by electricity from an Electrical Engineering Company's dynamo, which is now being installed.

GRASS VALLEY, Cal.—Joseph B. Kahn, formerly of the Mills building, San Francisco, has been appointed superintendent of the Grass Valley Gas and Electric Light Company.

FORT JONES, Cal.—Manuel Pereira is erecting an electric light plant using, Westinghouse apparatus, and work is progressing satisfactorily under the direction of P. F. Taylor.

GREAT FALLS, Mont.—John S. M. Neill, Surveyor General of Montana, is the principal member of a firm which has acquired the right to manufacture and use actylene in this State.

SAN FRANCISCO, Cal.—The San Francisco Gas Light Company has purchased a piece of property on the north side of Post street, between Powell and Mason streets, for $150,000 on which to erect a new building.

SAN MATEO, Cal.—The pole line for carrying the incandescent circuits of the San Mateo Electric Light Company to Belmont and on to the Belmont Military School has been completed.

ANAHEIM, Cal.—The municipal electric light plant is now being operated to its fullest capacity, and it is evident that it will soon have to be enlarged by the addition of an incandescent and arc lighting dynamo.

OAKDALE, Cal.—C. T. Tulloch, one of the proprietors of Knight's Ferry Flouring Mill, and who represents the Knight's Ferry Electric Light Plant, expects to extend his circuits to Oakdale and light the town.

FORT BRAGG, Cal.—The Fort Bragg Lumber Company has purchased a 45-kilowatt single-phase Westinghouse alternator complete, including transformer equipment. A plant will probably be installed in the Usal mill.

WILLOWS, Cal.—In retaliation for the act of the Board of Supervisors in ordering the electric lighting service in the court house and jail discontinued, the Willows Water and Light Company has discontinued rendering electric lighting service in the town.

MONROVIA, Cal.—The Monrovia Electric Power Company is making satisfactory progress in canvassing for sufficient patronage to warrant commencing work, and if the plant is installed its lighting circuits will be extended to Duarte. G. F. Buel is manager.

HANFORD, Cal.—W. H. Wilcox of Los Angeles, who is architect for the Kings county court house, favors lighting and heating the building by electricity and has drafted specfications accordingly, although provisions are made for steam or hot water heating if desired.

RIVERSIDE, Cal.—The Town Trustees have awarded the Redlands Electric Light and Power Company a contract with the city under which the company is to furnish power for all electric purposes in this city for twelve years. A similar contract has been closed with the city of Colton.

REDLANDS, Cal.—In order to develop the additional power necessary to supply the rapid extensions of its system in Riverside and Colton, the Redlands Electric Light and Power Company has ordered 3,200 feet of steel pipe which will be added to the head of the pipe line increasing the pressure from 300 to 550 feet.

SAN LEANDRO, Cal.—The $10,000 bonds recently voted for a municipal electric light plant have been sold to Hecht Bros. of San Francisco, but the sale has been temporarily enjoined by the gas company, in retaliation for which the trustees have adopted resolutions shutting off the gas lights in the streets and in all municipal departments and ordering coal oil lamps instead.

SAN FRANCISCO, Cal.—The incandescent circuits of the Parrott building are to be protected by forty Westinghouse circuit breakers of various capacities up to 1,000 amperes. The Electrical Engineering Company is building a 100-light, slow-speed, wrought iron rim dynamo for use on the excursion steamer that the Union Iron Works is building for Lake Tahoe.

SALT LAKE CITY, Utah.—Persistent rumors are afloat that the Salt Lake and Ogden Gas and Electric Light Company has bought out the plant and good will of the Citizens Electric Light Company, which, if true, will terminate the fierce war of rates that has lately been waged. Whether the report is true or not, it is definitely known that an agreement has been reached on rates.

SAN BERNARDINO, Cal.—The city authorities have made the discovery that the electric light and power company, which has been doing business for several years, has no franchise and the trustees have accordingly ordered the removal of its poles from the streets.—The San Bernardino Electric Company is endeavoring to secure additional water power by acquiring the water in Town creek.

VISALIA, Cal.—The City Council has rejected the bid of the Visalia Gas, Light and Heat Company for furnishing the city with arc lights during the ensuing year and has adopted a resolution authorizing the Mayor to appoint a committee to report upon the cost of establishing a new system of water works and an electric light plant for the city. Councilmen Hide, Brown and Levinson have been appointed as the committee named.

ALAMEDA, Cal.—The contract for the additional boiler and engines for the municipal electric light plant has been awarded to A. L. Fish, agent of the Buckeye Engine Company. The contract for erecting an addition to the station has been awarded for $1,970, and John Martin, Pacific Coast agent of the Stanley Electric and Manufacturing Company, has secured the contract for furnishing a 250-kilowatt Stanley two-phase alternator, together with all station equipments. An efficiency of 97¼ per cent is guaranteed.

BERKELEY, Cal.—It has been decided to bond the Berkeley Electric Lighting Company for $30,000, to be spent in purchase of new boilers, engines, dynamos, etc. An eighty-five-light arc dynamo has recently been added to the plant. The lighting and power plant in the mechanical engineering building of the State University is completed and the Library building is being lighted by incandescents though the arc circuits are not yet in operation. The plant comprises a 20-kilowatt Edison 110-volt generator for lighting and power purposes, twenty-five-light Sperry arc dynamo and a 500-light Westinghouse alternator.

LOS ANGELES, Cal.—E. W. Raymond of the Raymond Oil and Natural Gas Company has received a franchise to lay pipes for furnishing natural gas for fuel and heating purposes. He agrees to furnish gas at $1 per thousand and states that he is realizing 700,000 feet per day in a single well. The Los Angeles Electric Company has increased its plant by adding two new Corliss engines and four new boilers of 100 horsepower each, together with lighting generators aggregating 800 horsepower. The old switch boards have also been displaced by marble boards of the Westinghouse panel type. The plant is burning local crude oil. It is reported that Eastern hotel capitalists will erect a $100,000 hotel on the Grand View track and will light and heat the same by an electric plant.

MISCELLANEOUS.

SAN FRANCISCO, Cal.—The Electrical Engineering Company has just completed a 360-ampere plating dynamo for the California Artistic Metal Works.—The first anniversary and ball of the National Brotherhood of Electrical Workers, held on February 15th, constituted the most elaborate display of electrical decorative effects ever witnessed here. Over 1,000 incandescent lamps were woven into a network of flowers, palms and greenery so as to produce an endless variety of beautiful effects. A pendant star seven feet across hung in the center of the hall, and the initial letters of the order with the word "Welcome" was displayed in lamps representing the national colors. A monster phonograph called the dances and the twilight schottische was danced beneath a realistic moon and stars of light. The services of from twenty to forty men were employed for two weeks in preparing the display.

BERKELEY, Cal.—Some very successful photographs have been made with the Roentgen ray at the University of California through the use of a Crookes tube operated from an induction coil that in turn was supplied with single-phase alternating current at a periodicity of 233 alternations per second and which had an electro-motive force of 50 volts and about 4½ amperes, the angle of lag being 50 degrees. The best plate obtained was exposed 15 minutes, but better results were derived in an exposure of 2½ minutes than when an exposure of 1 hour was made. It is believed that much of the success achieved was due to the developer used and to the method by which the plates were developed. Th experiments were conducted by Professor Christy, who was assisted by Professor Cory and Instructors Drew and Le Conte. The plates were developed by O. V. Lange, the local photographer, who used a new developer of his own.

The "Annals of San Francisco," published in 1854, chronicles many an interesting fact now forgotten; an entry dated February 11, 1854: "The city was first lighted with coal gas on the evening of this day. The occasion was celebrated by several hundred citizens at a banquet given by the trustees of the 'San Francisco Gas Company,' in the Oriental Hotel. Already, about three miles of pipe were laid. At first, only a few principal streets and some of the leading hotels and large mercantile establishments were lighted with gas, but every day the number is increasing. The Metropolitan Theater, a few weeks after this date, adopted the new light. It will, of course, soon become general, and prove a great benefit to the city." En passant, it may be added that the price per thousand feet in that day was $15; coal, $36 to $40 per ton; labor, $6 to $7 per day, and interest 36 per cent per annum.—San Francisco Wave.

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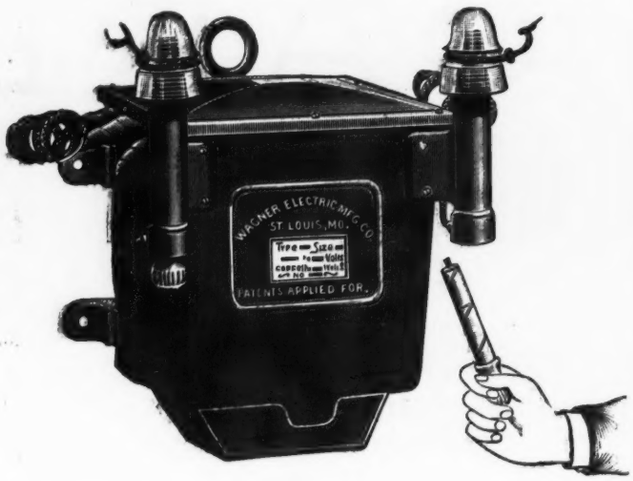

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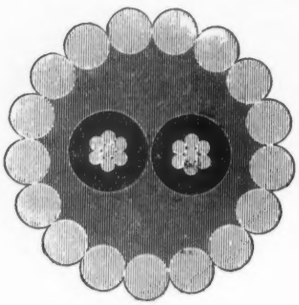

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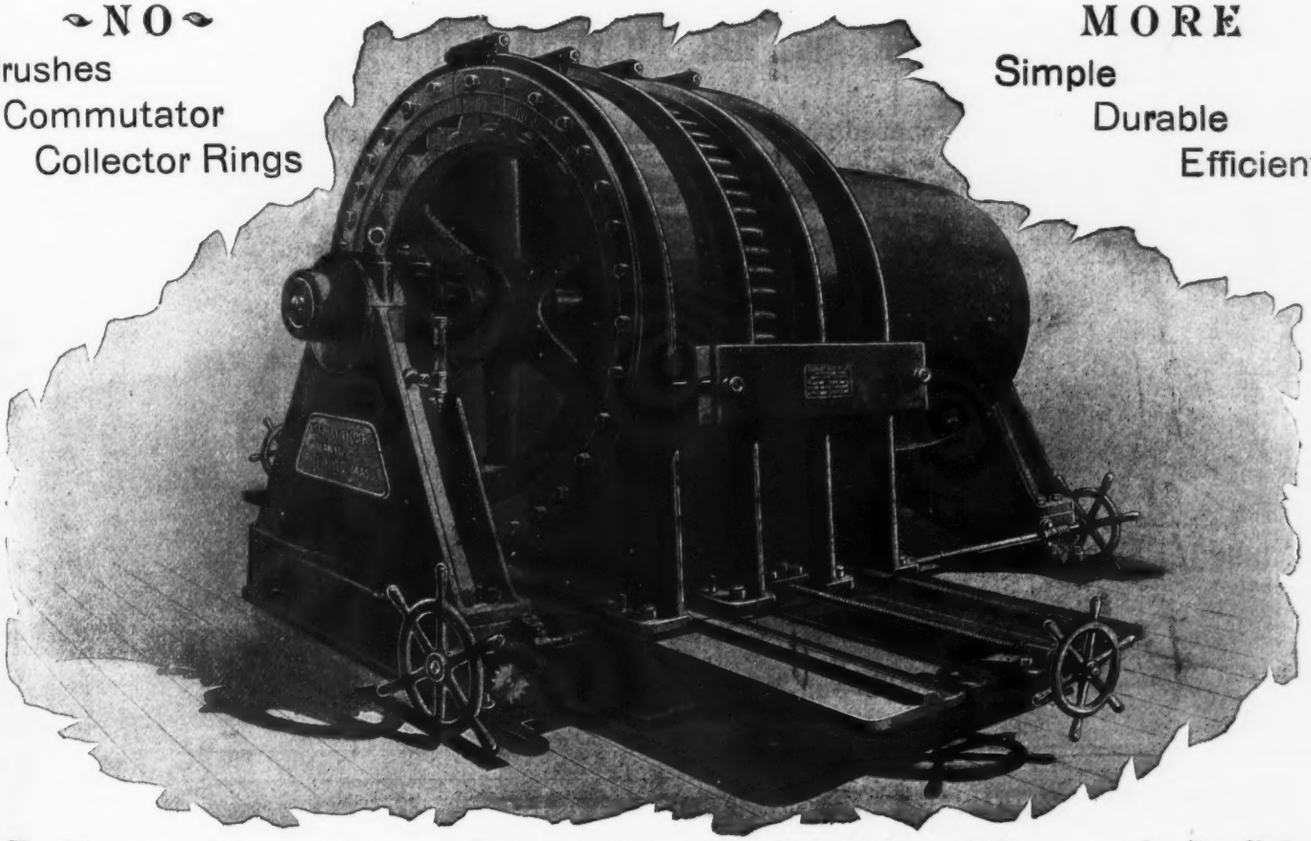

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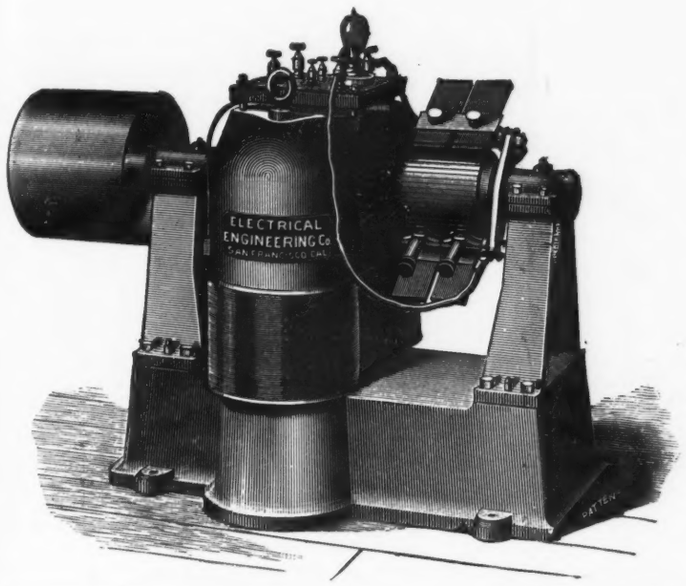

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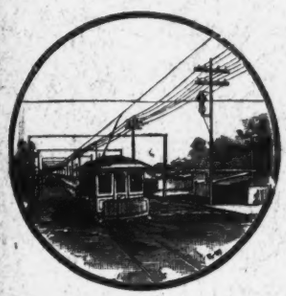

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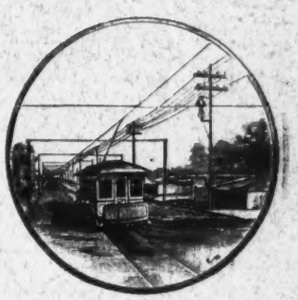

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